Evaluation of Fungicides for Control of Summer Patch

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Sponsor: Bayer, W.A. Cleary's, Novartis

Summary: In a replicated field trial at Hacienda Golf Club, La Habra Heights, CA, fungicides were tested at various rates, in various combinations and sequences for control of summer patch on a *Poa annua* putting green. Key results include:

- Heavy disease pressure was observed, with summer patch (*Magnaporthe poae*) causing the most severe damage. Anthracnose (*Colletotrichum graminicola*) and *Rhizoctonia* spp. were also present in test plots, and were responsible for turf damage as well.

- The best summer patch control was observed in fungicide rotation programs that used azoxystrobin (Heritage) or azoxystrobin and thiophanate-methyl (Cleary's 3336) in the latter part of the season, and a sterol inhibitor (tebuconazole or propiconazole) in the early part of the season. In addition to providing very good control of summer patch, anthracnose and *Rhizoctonia*, these programs have the additional merit of rotating among different classes of fungicides, and thus helping to avoid development of fungicide resistance.

- Rotations of Bayleton with Heritage, as well as the experimental product Compass (trifloxystrobin) provided some control of summer patch, but the overall control achieved was not acceptable, with these treatments performing significantly better than the check on only zero to two out of seven rating dates. The combination of Compass plus Banner did not perform any better than Compass alone. This may be due to the fact that the mixture was applied monthly, while the unaccompanied Compass (0.20 oz/1000) was applied bi-weekly.

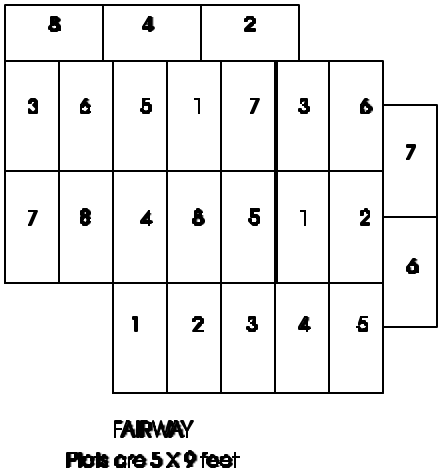
- All products provided excellent control of anthracnose, and most products (with the exception of trifloxystrobin) provided excellent control of *Rhizoctonia* spp.

Materials and Methods

Location: Research plots were located on a combination poa/bentgrass green at Hacienda Golf Club, La Habra Heights, CA.

Experimental design and application: Plots measuring 5 feet by 9 feet were replicated three times in a randomized design (see below).

Plot Plan. Hacienda Golf Club Chipping Green.



Treatments were applied with a CO_2 backpack sprayer equipped with 8008 VS flat fan nozzles and delivering 3.4 gallons of water per 1000 square feet, with 28 psi at the boom. This was accomplished by making two passes with the sprayer through each plot, delivering 1.7 gallons spray solution each pass. Calibration of each nozzle was confirmed prior to application to be within 5% of the desired nozzle flow rate. Boom height was 17 inches above the ground. The spray swath was 5 feet. Speed was 3 mph. Spray bottles were agitated by shaking 20 times

prior to charging with compressed CO_2. Spray lines were purged with CO_2 and then water prior to changing treatments.

Treatments: Treatments and application dates are listed in Table 1 below. Applications were initiated on 5/11/98.

Data Analysis: Data was subjected to analysis of variance, and treatment means separated using Fisher's LSD, where $P<0.05$. For analysis of variance, percent disease damage data was transformed to the arcsine (square root) of the proportion. Raw data and results of the statistical analysis are available on the accompanying floppy disk.

Table 1. Treatments, rates and application timing.

	Product	Active Ingredient	Rate/ 1000 sq ft	Application timing
1.	Compass 50 WP	trifloxystrobin (50%)	0.10 oz	5/11, 5/26, 6/8, 6/22, 7/8, 7/20, 8/3
2.	Compass 50 WP	trifloxystrobin (50%)	0.20 oz	5/11, 5/26, 6/8, 6/22, 7/8, 7/20, 8/3
3.	Compass + Banner Maxx (mixture)	trifloxystrobin (50%) + propiconazole (14.3%)	0.20 oz + 2.0 oz	5/11, 6/8, 7/8, 8/3
4.	Bayleton 50 WG/ Heritage (rotation)	triadimefon (50%)/ azoxystrobin (50%)	1.0 oz/0.4 oz	Bayleton: 5/11, 5/26, 6/8 Heritage: 6/22, 7/20
5.	Banner Maxx/Heritage (rotation)	propiconazole (14.3%)/ azoxystrobin (50%)	2 oz/0.4 oz	Banner Maxx: 5/11, 5/26, 6/8 Heritage: 6/22, 7/20
6.	Lynx 45/Heritage (rotation)	tebuconazole (45%)/ azoxystrobin (50%)	1.1 oz /0.4 oz	Lynx: 5/11, 5/26, 6/8 Heritage: 6/22, 7/20
7.	Banner Maxx/Cleary's 3336/Heritage	propiconazole (43%)/ thiophanate-methyl (50%) /azoxystrobin (50%)	2.0 oz/6 oz/0.2 oz	Banner Maxx: 5/11, 5/26, 6/8 Cleary's: 6/22, 7/20 Heritage: 7/8, 8/3
8.	No treatment			

Results and Discussion (Tables 2 and 3; Figures 2 and 3)

Identity of disease organisms: All disease identifications were confirmed both macroscopically (by examination of gross disease symptoms in the field) as well as microscopically, in the laboratory. Summer patch infection caused by *Magnaporthe poae* was first confirmed on 7/8/98 via microscopic examination, and was present in non-treated and several treated plots at every disease rating thereafter (Table 1). Summer patch caused the most damage to turf of the three disease organisms that were identified. The second most damaging disease identified was anthracnose caused by *Colletotrichum* spp., which was first noted in non-treated plots on 7/20/98. Causing more minor damage, an unidentified species of *Rhizoctonia* was first observed on 6/8/98, causing mild chlorotic rings in the affected plots. Based on the gross symptoms, it is likely that the disease was yellow patch, but this has not been confirmed.

Phytotoxicity: None of the products tested, with the exception of tebuconazole, caused any damage to turf. However, as in previous studies, tebuconazole applications resulted in temporary, but significantly lower, turfgrass quality ratings, apparently as a result of the sensitivity of *Poa annua* to this active ingredient. The significantly lower turf quality ratings in plots treated with tebuconazole on 6/8, 6/22 and 7/8 (Table 3) occurred, even though no disease organisms were identified in these plots. The *Poa annua* in the plots was uniformly affected, with discolored, thinning and yellowing turf visible from a distance.

As in the past, the effect was reversible, with full turf recovery (primarily through re-growth of bentgrass) observed four weeks after applications were ceased. It should be pointed out that the rate of product tested (0.5 oz active ingredient/1000 sq ft) in 1998 was even higher than tebuconazole rates (0.25 - 0.37 oz active ingredient/1000 sq ft) that had caused phytotoxicity in 1996 and 1997 trials. It is possible that lower rates of tebuconazole (<0.25 oz active ingredient/1000 sq ft) could produce a more gradual phase-out of poa that would be more visually acceptable. One important difference observed in 1998 was that the *Poa annua* biotypes present on the Hacienda Golf Club green appeared to be uniformly sensitive to tebuconazole, whereas the *Poa annua* biotypes present at a different location (Arrowhead Country Club) in the 1996 and 1997 studies appeared to have a differential response to tebuconazole, with phytotoxicity apparent only on patches of poa at this location.

Summer patch control: The presence of *M. poae* was first confirmed in the test area on 7/8/98. Therefore, all comments below on summer patch refer to ratings made on 7/8/98 and thereafter.

Among the best summer patch control treatments tested was the use of propiconazole (Banner Maxx) applied bi-weekly in May and early June, followed by a bi-weekly rotation of thiophanate-methyl(Cleary's 3336) and azoxystrobin (Heritage). This program outperformed the non-treated check on five out of seven rating dates. In addition to the inclusion of effective products in this rotational program, the fact that a fungicide was applied every two weeks may be responsible for the success of this rotation. In contrast, other rotational programs (that were somewhat less effective) that included a sterol inhibitor plus Heritage relied on monthly applications of Heritage during the period when summer patch pressure was the highest.

Another of the most successful treatments was a rotational program with bi-weekly applications of Lynx (tebuconazole) in May and June and monthly applications of Heritage thereafter. This effect was the result of Lynx's selective activity against poa annua (an effect also noted in 1996 and 1997 PACE tests with Lynx), which resulted in yellowed, undesirable turf quality in May and June (during and immediately after Lynx applications), but which allowed bentgrass colonization of Lynx treated areas by the time summer patch symptoms were evident. Because bentgrass is not sensitive to attack by summer patch, the turf quality in these plots was excellent once summer patch symptoms were apparent in July and August. The extremely high level of control achieve in July and August with this rotation must be balanced against the turf damage that was encountered earlier in the summer (see above).

Rotations of Bayleton with Heritage, as well as the experimental product Compass (trifloxystrobin) provided some control of summer patch, but the overall control achieved was not acceptable, with these treatments performing significantly better than the check on only one to two out of seven rating dates.

The sub-optimal performance of the Bayleton/Heritage rotation parellels the less than optimal results seen in PTRI's 1996 tests with Bayleton on summer patch. Because Heritage has demonstrated such strong activity against summer patch, we had hoped to see a good pairing that relied on the moderate performance of Bayleton early in the season, as a preventive fungicide, and Heritage later on in the season, when summer patch pressure was highest. The fact that the Heritage applications were not successful in curatively controlling summer patch in the Bayleton/Heritage rotation illustrates the importance of using highly effective products -- not only when summer patch symptoms are obviously expressed later in the summer, but also in the early part of the season, when applications are made on a preventive basis.

The sub-optimal performance of the trifloxystrobin may indicate that the rates tested were too low . The mild rate response observed with this product, with the higher rate (0.2 oz/100 sq ft) performing significantly better than the lower rate (0.1 oz/1000) on two rating dates, indicates that even higher rates (0.4 - 0.8 oz/1000 sq ft) might have provided improved performance. Another possibility is that the high volume of application (3.4 ga/1000 sq ft), combined with the heavy irrigation schedule practiced on Southern California greens during the summer months may have caused this product to move below the very short root system of the *Poa annua* plant.

The combination of Compass plus Banner did not perform any better than Compass alone. This may be due to the fact that the mixture was applied monthly, while the unaccompanied Compass (0.20 oz/1000) was applied bi-weekly.

Anthracnose and *Rhizoctonia* control: All products tested provided excellent control of anthracnose, with symptoms and presence of the disease organism observed only in non-treated check plots. Symptoms of damage caused by *Rhizoctonia* were present only in non-treated plots and plots treated with trifloxystrobin, indicating that this active ingredient was either not highly effective against this pathogen, or that perhaps one of the explanations suggested above may be in force. The symptoms in all affected plots were moderate, with 1-2 small chlorotic lesions present per affected plot.

Table 2. Date of occurrence of turf diseases occurring in test plots, Hacienda Country Club, CA. Diseases were initially identified by gross turfgrass symptoms. Presence of the pathogen was confirmed microscopically.

	Treatment	***Rhizoctonia* spp.h**	**Anthracnose**	**Summer Patch**
1	Compass: 0.10 oz	6/22		7/8 ,7/20, 8/3, 8/17, 9/1
2	Compass: 0.20 oz	6/8, 6/22		7/20, 8/3, 8/17, 9/1
3	Compass+Banner			7/20, 8/17, 9/1
4	Bayleton/Heritage			7/8, 7/20, 8/17, 9/1
5	Banner/Heritage			7/20, 8/17, 9/1
6	Lynx/Heritage			
7	Banner/Cleary's/ Heritage			8/17, 9/1
8	Non-treated	6/8, 6/22	7/20, 8/3, 8/17, 9/1	7/8, 7/20, 8/3, 8/17, 9/1

Table 3. Turf quality and percent disease ratings, Hacienda Country Club, CA. Values within the same column that are followed by the same letter are not significantly different (P<0.05). For analysis of variance, percent disease damage data was transformed to the arcsine (square root) of the proportion. Values shown in the table are non-transformed. On each rating date, treatments performing better than the check are noted in green shaded boxes, while treatments performing worse than the check are noted in red shaded boxes.

		6/8/98	6/22/98	7/8/98	7/20/98	8/3/98	8/3/98	8/17/98		9/1/98
	Treatment	**Quality**	**Quality**	**Quality**	**Quality**	**Quality**	**Percent Disease**	**Quality**	**Percent Disease**	**Percent Disease**
1	Compass 50 WP: 0.1 oz	6.2 d	5.9 bc	6.0 b	6.7 a	6.3 ab	4.3 bc	4.7 ab	28.3 cd	30.0 cd
2	Compass 50 WP: 0.20 oz	5.8 cd	5.8 bc	6.2 bc	6.6 a	6.6 bc	2.7 b	4.8 ab	20.0 bcd	20.0 bc
3	Compass+Banner mixture	6.0 cd	6.0 c	6.5 c	7.0 ab	6.4 ab	0.0 a	5.0 ab	29.0 cd	17.7 bc
4	Bayleton/Heritage rotation	5.0 b	5.7 b	6.3 bc	7.3 ab	6.8 bc	0.0 a	4.7 ab	25.7 bcd	19.2 bc
5	Banner/Heritage rotation	5.7 c	5.8 bc	6.3 bc	7.3 ab	6.8 bc	0.0 a	5.5 bc	15.0 bc	14.2 bc
6	Lynx/Heritage rotation	4.2 a	4.5 a	5.3 a	7.0 ab	7.3 d	0.0 a	7.8 d	0.0 a	1.3 a
7	Banner/Cleary's/ Heritage rotation	5.7 c	5.7 b	6.5 c	7.4 b	7.0 cd	0.0 a	6.3 c	5.7 ab	9.2 ab
8	Non-treated	6.0 cd	5.8 bc	6.0 b	6.6 a	6.1 a	5.3 c	3.8 a	45.0 d	43.3 d

Figure 2. Quality Ratings, 8/17/98. Hacienda Country Club

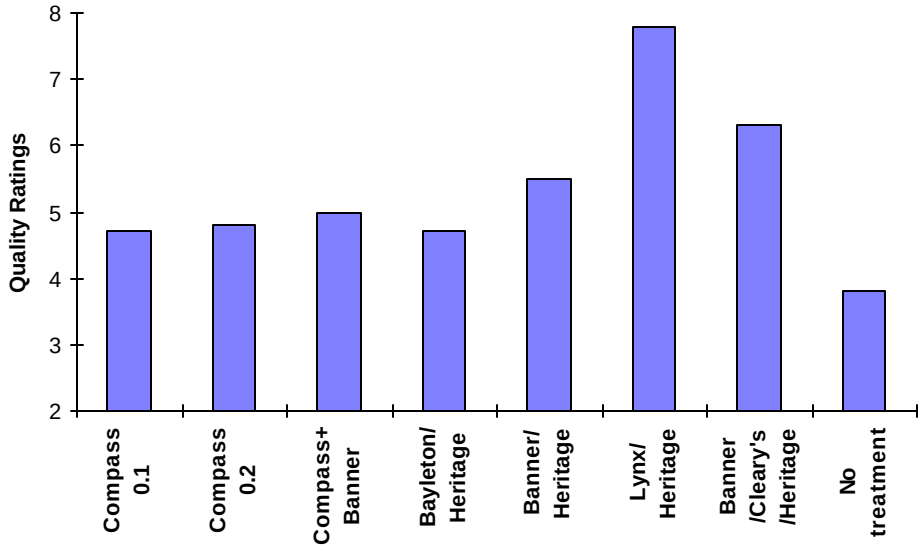


Figure 3. Percent Disease Incidence Ratings, 8/17/98. Hacienda Country Club.