

Characterization and Management of Bermudagrass Decline on Golf Course Greens

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Sponsors: Bayer, Novartis, Rohm and Haas, Zeneca

Summary: In replicated field trials conducted on a bermudagrass putting green, fungicides were tested for efficacy and phytotoxicity against symptoms of bermudagrass decline, caused by *Gaeumannomyces graminis*. Key results include:

- Summer temperatures that were significantly cooler than normal contributed to a lack of disease pressure at this site. Weak decline symptoms (irregularly shaped chlorotic patches, with both roots and foliage affected) were observed in the non-treated plots, and the presence of *Gaeumannomyces* was confirmed microscopically. However, damage due to disease in the non-treated plots was not significantly worse than in fungicide treated plots.
- As a result of lack of disease pressure, it was not possible to judge the products tested for their efficacy in controlling symptoms of bermudagrass decline.
- Applications of the sterol inhibitor fungicide Eagle produced significant phytotoxicity, probably as a result of a maximum air temperature of 100°F on the day of application. In contrast, the sterol inhibitor tebuconazole (Lynx) did not produce any significant signs of turf damage, nor did any of the other fungicides tested. These observations are similar to those reported from Florida by Elliott (1995). In contrast, results of several years of fungicide evaluations on poa/bent greens indicates that Eagle is one of the safest products to use on cool season turf, while tebuconazole applications resulted in significant phytotoxicity to *Poa annua*.
- With the possibility of Eagle induced phytotoxicity on bermudagrass greens indicated in trials from Florida and California, it is recommended that this product be re-

evaluated next summer in a variety of locations to further investigate this phenomenon.

- Bermudagrass decline caused by *Gaeumannomyces graminis* var. *graminis* appears to be an increasing problem on greens. Background information on this disease appears at the end of this report.

Materials and Methods:

Locations: Research plots were located on a hybrid bermudagrass putting green with a history of summer decline symptoms. The green was located at Sun City West, Palm Desert, CA, Nancy Dickens, superintendent.

Experimental design and application: Plots measured 5 feet by 10 feet and treatments were replicated three times, in a randomized design.

Treatments were applied with a CO₂ backpack sprayer equipped with 8008 VS flat fan nozzles and delivering 3.46 gallons of water per 1000 square feet, with 28 psi at the boom. 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 CO₂. Spray lines were purged with CO₂ and then water prior to changing treatments. Application was followed by irrigation (approximately 1/10 inch of water)

Treatments: Treatment and application dates are listed in Table 1 below.

Results (Tables 1 and 2)

Plots were evaluated for signs of disease damage and/or phytotoxicity on a monthly basis (and sometimes bi-weekly basis), beginning April 23, 1999 and ending August 19, 1999. There was no

significant damage directly attributed to *Gaeumannomyces graminis*, although the fungus was isolated from areas showing weak (non-significant) symptoms of bermudagrass decline. On July 16 (one month after the final application of Eagle), however, there was significant damage associated with applications of the fungicide Eagle. By the next evaluation date (six weeks after the final application of Eagle, 8/3/99) the turf had almost completely recovered from this damage. The damage almost certainly was the result of the final application of Eagle on June 17, 1999, a day when the average air temperature was 86°F and the maximum was 100°F (Table 2). There had been no damage noted following earlier applications, made when air temperatures were cooler (Table 2), and the fact that the turf slowly recovered once applications stopped also points to the 6/17 application date as the culprit.

This is presumed to be the same type of phytotoxicity noted by Elliott in her 1995 paper on bermudagrass decline, although she also observed significant damage from Bayleton applications. Although Bayleton produced some minimal damage to turf in these trials, neither the damage produced nor the turf quality was significantly different from the non-treated check.

We have observed the safety of Eagle when applied to cool season greens, even when air temperatures are above 90°F. For this reason, the damage we observed in this trial to bermudagrass greens when the air temperature was above 90°F was troubling, especially since this observation was confirmed in studies conducted by Elliott (1995) in Florida. Additional tests are needed to investigate these observations, and to determine whether Eagle's use recommendations should include information about the temperature sensitivity of bermudagrass.

On the other hand, the safety of the other fungicides tested was notable. Safety of the sterol inhibitor tebuconazole to bermudagrass during high temperatures was also observed by Elliott, suggesting that this experimental material may have some value in the management of ectotrophic root infecting fungi on bermudagrass.

References

Elliott, M.L. 1995. Effect of systemic fungicides on a bermudagrass putting green infested with *Gaeumannomyces graminis* var. *graminis*. Plant Disease 79:945-949.

Table 1. Treatments, application dates, turf quality and turf damage ratings. Quality was rated on a 0 – 9 scale, with 0 = dead turf and 9 = best possible turf. Turf damage resulted from a combination of disease damage and phytotoxicity. For analysis of variance, percent turf damage data was transformed to the arcsine (square root of the proportion). Values shown in the table are non-transformed. Values within the same column that are followed by the same letter are not significantly different (P<0.10).

Trt	Product	Active ingredient	Rate/100 sq ft	Application dates	7/16/99 Ratings	
					% Turf damage	Mean quality
1	No treatment				1.7 ab	7.0 abc
2	Heritage 50 WG	azoxystrobin	0.4 oz	4/23	6.0 b	6.5 abc
3	Heritage 50 WG	azoxystrobin	0.4 oz	4/23, 5/21	0.0 a	7.3 a
4	Heritage 50 WG	azoxystrobin	0.4 oz	4/23, 5/21, 6/17	3.3 ab	6.7 abc
5	Heritage 50 WG	azoxystrobin	0.4 oz	7/16	0.0 a	7.2 ab
6	Bayleton 50	triadimefon	1.0 oz	4/23, 5/21, 6/17	4.3 b	6.2 c
7	Lynx 45	tebuconazole	0.56 oz	4/23, 5/21, 6/17	1.7 ab	6.8 abc
8	Compass	trifloxystrobin	0.2 oz	4/23, 5/21, 6/17	1.7 ab	6.8 abc
9	Compass	trifloxystrobin	0.4 oz	4/23, 5/21, 6/17	4.3 b	6.3 bc
10	Eagle WSP	myclobutanil	1.2 oz	4/23, 5/21, 6/17	18.3 c	4.7 d

Table 2. Minimum, average and maximum air temperatures on fungicide application dates (temperature data obtained from CIMIS Station 118, Cathedral City, CA), and measurements made at the research site, at the time of application.

Application date	°F from CIMIS Station 118			°F @Research site
	Minimum	Average	Maximum	(time of applic)
4/23/99	54	61	70	65 (7:30am)
5/21/99	57	68	82	67 (7:00am)
6/17/99	69	86	100	78 (6:15am)

Bermudagrass decline: background information

The cause: *Gaeumannomyces graminis* var. *graminis*.

The victim: Bermudagrass greens (“Tifgreen”, alias “328” and “Champion” are particularly susceptible. “Tifdwarf”, which stands up to low mowing better, is not damaged as badly, but can still suffer significantly). This pathogen is also harbored in bermudagrass fairways, but symptoms are only infrequently exhibited.

The timing: Appearance of dead and dying turf is usually first noted between July and September.

Management through stress reduction: Cultural practices that reduce stress will lessen the damage from this pathogen.

1. Pay special attention to the development of symptoms following humid or rainy weather, and during prolonged periods of very warm (average air temperatures above 90°F) weather.
2. Promote root growth, including deep tine aeration, with holes filled with compatible root zone sand at least once each spring.
3. Raise mowing height if possible to 3/16” or higher. Light, frequent topdressing will help keep greens speeds up, and will also help fight algae.
4. When turf shows signs of stress, reduce traffic, and eliminate the clean-up lap during mowing.
5. Balance soil fertility. Where feasible (usually areas with low pH irrigation water and/or heavy rainfall), attempt to gradually reduce soil pH to roughly 5.2 through the use of ammonium based fertilizers. Adequate potassium and manganese may also help the plant fight off the disease.

6. Avoid invasion of algae (through applications of chlorothalonil) into dead spots, as they will inhibit the ability of bermudagrass to re-colonize.
7. On irrigated fairways, evaluate irrigation distribution uniformity and adjust accordingly. Stress caused by too much (or too little) water is a factor in *Gaeumannomyces* infections.

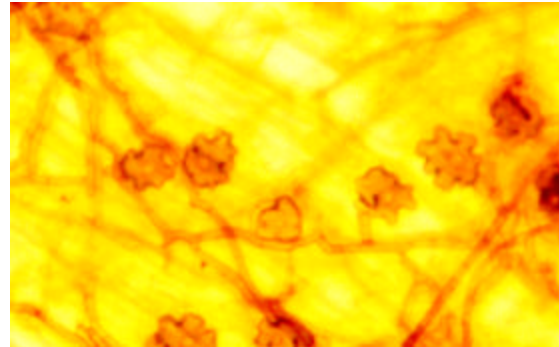
Preventive systemic fungicide applications:

1. If bermudagrass decline is a perennial problem, initiate a preventive fungicide program beginning when average air temperatures exceeds 88° F (or when average soil temperature at a 6 inch depth is 80°F). This temperature trigger – our current best estimate -- was identified through our observations on bermudagrass greens in the desert southwest.
2. Fungicides must be systemic to be effective. Sterol inhibitor fungicides (Banner Maxx, Bayleton, Eagle and Rubigan) should be used with caution, since research in Florida and California has indicated that phytotoxicity can result, even when air temperatures are relatively cool.
3. Products which are effective against ERI fungi and do not appear to cause phytotoxicity to bermudagrass during hot weather include Heritage, Lynx (currently not registered, but of interest because it is one of the few sterol inhibitors that does not cause turf damage) and benzimidazole products such as Cleary’s 3336 or Fungo Flo. These products should be used as described on the label, watered in after application, and should be applied until average air temperatures go below 88° F.

Curative fungicide applications: Once disease strikes, more aggressive steps are needed to help the plants to recover.

1. If decline hits unexpectedly and severely, evaluate the use of Heritage at 0.4 oz/1000 sq ft watered in and applied twice at a 14 day interval. You can drop back to application every 28 days after the second application. This should be continued until air temperatures fall below 88° F.
2. Keep the turfgrass surface moisture adequate for new roots to develop from the crown of the plant. Assume that the deep roots are unable to provide moisture or nutrition.
3. Apply ¼ lb N/1000 sq ft weekly using a complete foliar feed (e.g. Peter's or Nutriculture 20-20-20).
4. Combat algae using chlorothalonil (e.g. Daconil Ultrex 6 oz/1000 sq ft) applied in not more than 2 gal/1000 sq ft and not watered in.

Micrograph of dark ectotrophic runner hyphae and lobate hyphopodia associated with bermudagrass decline. Approximate magnification 400 X.



Poor turfgrass quality on a hybrid bermuda green infected by *G. graminis*.

