

Evaluation of EcoGuard for control of anthracnose basal rot, 2004.

EcoGuard, a biofungicide containing *Bacillus licheniformis*, was evaluated for its ability to suppress anthracnose basal rot development when applied alone or in combination with select fungicides. This trial was conducted at the Lake Wheeler Turfgrass Field Lab in Raleigh, NC on 'Penncross' creeping bentgrass maintained under golf course putting green conditions. Mowing was performed 3 times weekly at a height of 0.156 in. with clippings collected. The site was irrigated only as needed to prevent severe drought stress and encourage anthracnose basal rot development. Fertilizer was applied as 19-5-9 on 5 Jan, 2 Feb, and 1 Apr (0.5 lb N/1000 sq ft) and as 25-5-15 on 5 Mar (1 lb N/1000 sq ft), 23 Apr (0.5 lb N/1000 sq ft), and 13 May (0.5 lb N/1000 sq ft). Insect pests were suppressed with Dursban Pro (1 fl oz/1000 sq ft) on 7 May, 9 Jul, and 25 Aug and with Talstar (0.25 fl oz/1000 sq ft) on 9 May and 12 Aug. Surfside Wetting Agent (6 fl oz/1000 sq ft) was applied on 7 May, 14 Jun, and 9 Jul to control localized dry spots. Plots were 3.33 ft x 6 ft and were arranged in a randomized complete block with four replications. Fungicides were applied in water equivalent to 2 gal per 1000 sq ft with a CO₂ powered sprayer at 40 psi using TeeJet 8004 nozzles. All treatments were initiated on 1 Jun and were reapplied at the appropriate intervals as indicated in the table. Percent turf area exhibiting anthracnose basal rot symptoms was assessed on 28 Jun, 6 Jul, 13 Jul, 22 Jul, and 13 Aug. Turfgrass quality was evaluated on 22 Jul and 14 Aug, using a 1 to 9 scale (9=best, 5=acceptable) based on color, density, and uniformity. Data were subjected to analysis of variance and means separation by Waller-Duncan k-ratio t test (k=100).

Anthracnose basal rot developed from natural inoculum sources in late June following a 6 day period of overcast weather. The disease continued to progress throughout July and August due to stress from low nitrogen levels and drought imposed on the experimental area. No significant differences in anthracnose incidence were detected among treatments from late June through mid July. All fungicide treatments, except Heritage (0.2 oz, 28 day), provided good to excellent control of anthracnose basal rot on 22 Jul. In addition, plots treated with EcoGuard (20 fl oz, 14 day) and WP140 exhibited significantly less anthracnose symptoms than the untreated control. Heritage (0.2 oz, 28 day) was not significantly different from the untreated control on 22 Jul, but the rotation of Heritage and EcoGuard provided excellent anthracnose control on this date. On 13 Aug, all Daconil Ultrex treatments provided significant anthracnose control. The addition of EcoGuard to Daconil Ultrex in tank mixtures or rotations did not provide further reductions in disease incidence. Neither Heritage treatment suppressed anthracnose incidence on 13 Aug, but the addition of EcoGuard to Heritage in tank mixtures or rotations significantly reduced disease incidence compared Heritage alone or the untreated control. WP140 reduced anthracnose incidence on 13 Aug when applied on 7 day intervals, but not when applied on 14 day intervals.

EcoGuard, WP140, and WP145 did not significantly improve turfgrass quality when compared to the untreated control on 22 Jul or 14 Aug. Combinations of EcoGuard with Daconil Ultrex or Heritage in tank mixtures or rotations significantly improved turfgrass quality compared to the untreated control on 22 Jul, whereas the fungicides alone did not improve quality. On 14 Aug, combinations of Heritage and EcoGuard significantly improved turfgrass quality compared to the untreated control, whereas Heritage alone did not improve quality. All EcoGuard treatments induced a noticeable improvement in turf color, likely due to the presence of plant available nitrogen in the product formulation. The improvement in turf color was primarily responsible for the increase in turf quality ratings. EcoGuard has suppressive activity against anthracnose basal rot when applied in tank mixtures or rotations with fungicides, but the role of nitrogen in the EcoGuard formulation in suppression of anthracnose basal rot requires further investigation.

Table 1. Evaluation of EcoGuard for control of anthracnose basal rot, 2004.

| Treatment and rate / 1000 sq ft | Spray interval (days) | Anthracnose basal rot incidence (%) | | | | | Turf quality ^z | |
|--|-----------------------|-------------------------------------|-------|--------|--------|--------|---------------------------|---------|
| | | 28 Jun | 6 Jul | 13 Jul | 22 Jul | 13 Aug | 22 Jul | 14 Aug |
| EcoGuard SC 20 fl oz..... | 7 ^y | 4 a ^x | 7 a | 4 a | 16 a-d | 44 a | 4.3 cde | 2.0 g |
| EcoGuard SC 20 fl oz..... | 14 | 9 a | 9 a | 13 a | 12 b-f | 35 abc | 4.3 cde | 2.8 efg |
| Daconil Ultrex 82.5WDG 1.62 oz..... | 14 | 4 a | 6 a | 9 a | 10 b-f | 25 bcd | 5.8 a-d | 4.3 cde |
| Daconil Ultrex 82.5WDG 2.45 oz..... | 14 | 3 a | 7 a | 8 a | 8 c-f | 12 def | 5.0 a-e | 4.8 cd |
| Daconil Ultrex 82.5WDG 3.2 oz..... | 14 | 1 a | 4 a | 5 a | 7 def | 10 def | 5.0 a-e | 5.3 abc |
| Daconil Ultrex 82.5WDG 3.2 oz..... | 28 | 8 a | 6 a | 12 a | 10 b-f | 16 def | 5.3 a-e | 4.3 cde |
| Heritage 50WG 0.1 oz..... | 14 | 8 a | 9 a | 7 a | 11 b-f | 41 a | 4.3 cde | 2.3 g |
| Heritage 50WG 0.2 oz..... | 28 | 8 a | 6 a | 4 a | 14 a-e | 36 abc | 4.8 b-e | 3.0 efg |
| Daconil Ultrex 82.5WDG 3.2 oz alt EcoGuard SC 20 fl oz..... | 14 | 5 a | 5 a | 5 a | 9 b-f | 12 def | 5.8 a-d | 5.0 bc |
| EcoGuard SC 20 fl oz + Daconil Ultrex 82.5WDG 3.2 oz.... | 14 | 2 a | 3 a | 3 a | 4 ef | 5 f | 6.3 abc | 6.8 a |
| EcoGuard SC 20 fl oz + Daconil Ultrex 82.5WDG 2.45 oz.. | 14 | 1 a | 4 a | 2 a | 1 f | 7 ef | 7.3 a | 6.5 ab |
| EcoGuard SC 20 fl oz + Daconil Ultrex 82.5WDG 1.62 oz.. | 14 | 0 a | 1 a | 2 a | 3 ef | 10 def | 7.0 ab | 5.0 bc |
| Heritage 50WG 0.2 oz alt EcoGuard SC 20 fl oz..... | 14 | 5 a | 2 a | 1 a | 3 ef | 19 def | 6.8 ab | 4.3 cde |
| EcoGuard SC 20 fl oz + Heritage 50WG 0.1 oz..... | 14 | 2 a | 2 a | 2 a | 5 def | 16 def | 6.8 ab | 4.0 c-f |
| WP 140 WP 5 oz | 7 | 5 a | 4 a | 4 a | 10 b-f | 23 cde | 4.8 b-e | 3.3 d-g |
| WP 140 WP 5 oz | 14 | 11 a | 8 a | 12 a | 11 b-f | 36 abc | 4.3 cde | 2.0 g |
| WP 145 WP 1 oz | 7 | 9 a | 11 a | 7 a | 20 abc | 44 a | 3.0 e | 2.0 g |
| WP 145 WP 1 oz | 14 | 5 a | 8 a | 3 a | 20 abc | 40 ab | 3.8 de | 2.3 g |
| Untreated Control | -- | 15 a | 17 a | 12 a | 21 ab | 41 a | 4.0 cde | 1.8 g |
| Untreated Control | -- | 16 a | 16 a | 17 a | 25 a | 44 a | 3.3 e | 2.5 fg |

^zTurfgrass quality on a 1 to 9 scale, where 9=highest quality and 5=acceptable quality.

^yFungicides were applied on 1 Jun (all treatments), 8 Jun (7 day treatments), 15 Jun (7 and 14 day treatments), 22 Jun (7 day treatments), 29 Jun (all treatments), 6 Jul (7 day treatments), 13 Jul (7 and 14 day treatments), 22 Jul (7 day treatments), 29 Jul (all treatments), and 5 Aug (7 day treatments).

^xValues are means of four replicates. Means within columns followed by the same letter are not significantly different according to Waller-Duncan k-ratio t-test (k=100).