CONTROL OF BLACK TURFGRASS ATAENIUS ADULTS AND GRUBS WITH ADULTICIDES AND LARVICIDES

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Summary:

A trial evaluating the efficacy of various insecticides for control of black turfgrass ataenius adults and grubs was initiated on a bentgrass nursery at Los Coyotes Country Club, Buena Park, CA. Key results include:

- The strategy of using pyrethroid insecticides to target adult black turfgrass ataenius (BTA) to control subsequent generations of BTA grubs was shown to have merit, if applications can be carefully timed to target the peak summer generation(s) of adults. Using this strategy, grub control was observed for as long as eleven weeks after insecticide application.
- Various formulations and rates of two different pyrethroid insecticides (λ cyhalothrin [Scimitar] and deltamethrin [Deltagard]) produced significant reductions in both adult and grub counts on most sampling dates, with the exception of the low rate (0.11 oz/1000 sq ft) of the Scimitar 10 WP formulation, which failed to produce significant reductions in grub populations.
- The performance of a larvicidal product, thiamethoxam, was excellent, with grub populations maintained at extremely low levels for the duration of the trial (11 weeks). Both formulations of thiamethoxam (granular and wettable granule) performed as well as imidacloprid (Merit), the current commercial standard for white grub control. Despite the very good performance of some of the pyrethroid formulations, the two larvicidal products tested (thiamethoxam and imidacloprid) provided more consistent and more effective control of larval BTA for the duration of the trial. In addition, the application timing requirements for the larvicidal products are less stringent than for adult-active pyrethroids, making the larvicides somewhat easier to use effectively.

Materials and Methods

Location: Research plots were located on a bentgrass nursery at Los Coyotes Country Club, Buena Park, CA. The site was chosen on the basis of a history of BTA infestations.

Experimental design and application: Plots measuring 6 feet by 15 feet were replicated four times in a randomized design (Figure 1). Sprayable treatments were applied with a CO_2 backpack sprayer equipped with 8004 VS flat fan nozzles and delivering 0.98 gallons of water per 1000 square feet, with 30 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 10 times prior to charging with compressed CO_2. Spray lines were purged with water and then CO_2 prior to changing treatments. Granular treatments were applied to each plot via hand held shakers with six ¼" holes drilled in the top (for Deltagard applications) or with three 11/64" holes drilled in the top (for thiamethoxam 0.22 G applications). Plots were irrigated with 1/10" water immediately after application.

Treatments: Treatments tested, and application dates are listed in Table 1 below. Adulticide products were applied twice, on 7/14 and 7/20/98. Application timing was based on previously generated black light trapping data on the activity of BTA adults (PTRI 1998 Turfgrass Research Report: 1997 Turf Insect Monitoring Study Results), which showed that peak populations were observed in late June/early July of each year. Based on this data, sampling for adults (as described below) was initiated in late June, 1998 at the test site. The trial was initiated (7/14/98) when an average of two or more adults were detected per 8 square foot area, as described below. Larvicide applications (thiamethoxam and imidacloprid) were initiated on the same date

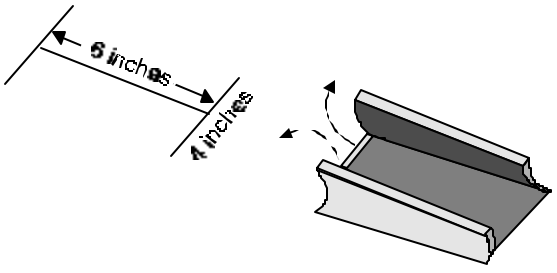
(7/14/98), with only one application made for the duration of the trial.

Table 1. PRODUCTS TESTED

	Product	Active Ingredient	Rate/1000 sq ft	Dates of application
1	Non-treated check			
2	Merit 75 WSP	imidacloprid	0.15 oz	7/14/98
3	CGA 293,343 25 WG	thiamethoxam	0.30 oz	7/14/98
4	CGA 293,343 0.22 G	thiamethoxam	33 oz	7/14/98
5	Scimitar 10 WP	λ cyhalothrin	0.11 oz	7/14/98, 7/20/98
6	Scimitar 10 WP	λ cyhalothrin	0.22 oz	7/14/98, 7/20/98
7	Scimitar 10 CS	λ cyhalothrin	0.11 oz	7/14/98, 7/20/98
8	Scimitar 10 CS	λ cyhalothrin	0.22 oz	7/14/98, 7/20/98
9	Scimitar 25 CS	λ cyhalothrin	0.05 oz	7/14/98, 7/20/98
10	Scimitar 25 CS	λ cyhalothrin	0.10 oz	7/14/98, 7/20/98
11	Deltagard GC	deltamethrin	2 lb	7/14/98, 7/20/98
12	Deltagard GC	deltamethrin	3 lb	7/14/98, 7/20/98

Evaluations (Adult Counts): The number of adult BTA was determined on three different dates (7/15, 7/20 and 7/28/98) by counting the number of adults that appeared following application of an irritant solution of Lemon Joy (20 ml Lemon Joy/6 liters water) applied to an 8 square foot area of turf. A rectangle of aluminum screen frame measuring 2 feet by 4 feet was used to mark the counting area. The counting rectangle was placed in a different position on each evaluation date to avoid the possibility of erroneously lower counts due to any mortality that BTA adults might suffer following exposure to the soap irritant solution.

Evaluations (Larval Counts): The number of black turfgrass ataenius grubs was determined by examining 3 sites per plot on each evaluation date, as illustrated below.



Using a knife, a six inch long straight line was cut through the turf, cutting deeply enough to go just beyond the thatch. Perpendicular lines about 4 inches long are cut to form a "T" at either end (diagram on left). Turf was peeled back to examine soil for grubs and pupae.

Data was subjected to analysis of variance, and treatment means were separated using Fisher's LSD, where $P<0.10$ (data print-out attached). In addition, a linear regression was conducted to determine the correlation between the number of adults and the number of grubs present, where $P<0.05$ for the correlation to be significant.

Results

BTA population densities vs. turfgrass damage: Significant populations of BTA grubs were observed in non-treated plots, with more than 3 grubs/2 square feet recorded on most sampling dates. However, little or no damage to the bentgrass turf was observed, largely because the trial was conducted on a nursery, rather than on an in-play green. As a result, the turf damage that can occur when grub feeding is exacerbated by compaction (due to foot traffic) was not observed.

Phytotoxicity and Product Handling: None of the products tested caused any phytotoxicity to turf. All products handled well. However, the low density of the CGA 293,343 granule could be problematic in the event of a breezy day. Plots treated with Deltagard GC had darker green turf

on 7/28/98 (8 days after the second application), with the 3 lb/1000 square foot rate producing a darker green color than the 2 lb/1000 sq ft rate. It is likely that this effect is due to the presence of nitrogen in the GC granule.

Adult BTA Control: The objective of BTA adult control is to reduce populations of the subsequent generation of BTA grubs. When the adult counts (averaged over all three adult sampling dates) for each treatment were regressed against the average grub counts (averaged over the 8/13, 9/8 and 9/30 sampling dates) for each treatment, a significant (P=0.002) positive correlation was observed (Figure 1), indicating that a reduction in the number of adult BTA did in fact result in a reduction in the number of larval BTA in each treatment plot. For this reason, there is merit to the strategy of adult BTA control. However, applications must be carefully timed to target the peak summer generation of adults, or else they will be ineffective. This strategy therefore requires good knowledge of the population dynamics of BTA in each region. It is likely that the timing of peak populations of BTA adults will vary from region to region, and from year to year, depending on weather conditions.

For control of black turfgrass ataenius (BTA) adults, two different pyrethroid active ingredients (lambda cyhalothrin [Scimitar] and deltamethrin [Deltagard]) were tested. All products tested caused significant reductions in adult counts on one or more sampling dates (Table 2), with Scimitar 10 CS and Scimitar 25 CS producing the best results on all three sampling dates, regardless of the rate tested. However, the low rate of Deltagard GC (2 lb/1000 sq ft) had the highest counts of adults BTAs on two out of three sampling dates. This did not, however, appear to influence the level of grub control seen later in the trial (see below), with both rates of Deltagard GC providing similar levels of grub control. It is possible that the 2 lb/1000 square foot rate is just slightly on the low side under the conditions of this trial; to ensure consistent performance, a higher rate may be advisable. The low rate of Scimitar 10 WP (0.11 oz) had the highest adult counts on one out of three sampling dates. This formulation of Scimitar also produced high BTA grub counts on several sampling dates, indicating that there are some performance issues with this particular formulation.

Figure 1. Linear regression illustrating the correlation between adult BTA and larval BTA populations.

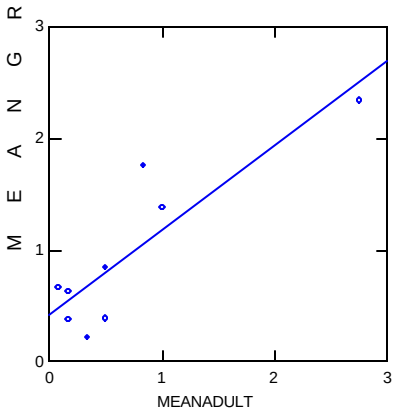


Table 2. Mean number of black turfgrass ataenius adults observed per 8 square feet when an irritant solution was applied to turfgrass. Values within the same column that are followed by the same letter are not significantly different (Fisher's LSD, P<0.10).

				mean # adult BTA/8 sq ft		
		Active Ingredient	**Rate/1000 sq ft**	**7/15 (1 DAT)**	**7/20 (6 DAT)**	**7/28 (14 DAT)**
1	Non-treated check			2.75 c	4.25 c	1.25 c
5	Scimitar 10 WP	λ cyhalothrin	0.11 oz	1.25 ab	1.0 b	0.25 a
6	Scimitar 10 WP	λ cyhalothrin	0.22 oz	1.0 ab	0.0 a	0.0 a
7	Scimitar 10 CS	λ cyhalothrin	0.11 oz	1.0 ab	0.5 ab	0.0 a
8	Scimitar 10 CS	λ cyhalothrin	0.22 oz	0.5 a	0.0 a	0.0 a
9	Scimitar 25 CS	λ cyhalothrin	0.05 oz	0.25 a	0.0 a	0.0 a
10	Scimitar 25 CS	λ cyhalothrin	0.10 oz	0.5 a	0.0 a	0.0 a
11	Deltagard GC	deltamethrin	2 lb	2.25 bc	0.0 a	0.75 b
12	Deltagard GC	deltamethrin	3 lb	1.25 ab	0.25 ab	0.0 a

Larval BTA Control: In general, the larvicidal products tested (thiamethoxam and imidacloprid) provided more consistent control of BTA grubs than the adult-active pyrethroids (Table 3). The excellent control observed with both larvicides occurred regardless of the formulation type tested.

The strategy of targeting adult BTA as a means of controlling BTA grubs also provided good to excellent results. With the exception of the low rate (0.11 oz/1000 sq ft) of Scimitar WP, all of the pyrethroid products provided comparable levels of control of BTA grubs. Although this strategy is a bit more difficult to implement (due to the requirement for accurate timing of the adulticide sprays), it has the benefit of supplying superintendents with a different mode of action to employ against BTA, and thus a strategy that could delay or prevent resistance to the chloronicotinyl compounds, such as imidacloprid.

A Note on Curative Control of BTA Grubs: In this test, preventive control of BTA grubs was the objective. However, it is highly desirable to most superintendents to use products that have both curative and preventive control. Although not listed on the product label, imidacloprid is broadly accepted to have curative control on white grubs, particularly when they are in the early instars. Label recommendations for curative control of white grubs would provide an important competitive advantage for any of the products tested, if data exists to support this claim.

Table 3. Mean number of black turfgrass grubs observed per sampling site (6" X 4"). A total of 3 sampling sites were evaluated per plot, per sampling date. The best performing treatments are highlighted in green shaded boxes. Values within the same column that are followed by the same letter are not significantly different (Fisher's LSD, P<0.10).

		MEAN BTA COUNTS/24 SQ IN							
		8/13/98 (4 WAT)			9/8/98 (8 WAT)			9/30/98 (11 WAT)	10/30/98 (15 WAT)
		# grubs	# pupae	# grubs + pupae	# grubs	# pupae	# grubs + pupae	# grubs	# grubs
1	Non-treated check	1.25 ab	1.17 b	2.42 b	3.42 c	0.50 b	3.92 c	3.42b	0.58a
2	Merit 75 WSP	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.25a	0.00a
3	CGA 293,343 25 WG	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	1.33a	0.42a
4	CGA 293,343 0.22 G	0.0 a	0.0 a	0.0 a	0.42 a	0.17 a	0.58 a	0.17a	0.42a
5	Scimitar 10 WP	0.75 ab	1.25 b	2.0 b	2.75 bc	0.01 a	2.83 bc	5.42c	
6	Scimitar 10 WP	0.17 a	0.75 ab	0.92 ab	0.25 a	0.01 a	0.33 a	1.67ab	
7	Scimitar 10 CS	1.67 b	0.42 ab	2.08 b	0.01 a	0.01 a	0.17 a	0.50a	
8	Scimitar 10 CS	0.83 ab	0.33 ab	1.17 ab	0.42 a	0.0 a	0.42 a	0.42a	
9	Scimitar 25 CS	0.0 a	0.01 a	0.01 a	1.33 ab	0.25 ab	1.58 ab	1.50a	
10	Scimitar 25 CS	0.75 ab	0.92 ab	1.67 ab	0.0 a	0.01 a	0.01 a	0.42a	
11	Deltagard GC	1.75 b	0.0 a	1.75 ab	1.0 a	0.0 a	1.0 a	1.50a	
12	Deltagard GC	0.75 ab	0.01 a	0.83 ab	0.01 a	0.0 a	0.01 a	1.25a	

Figure 1. Plot Plan. Bentgrass nursery, Los Coyotes Country Club, Buena Park, CA.

8	6	4	2	9	1	5	12	11	3	7	10
4	11	7	5	10	8	1	3	9	12	6	2
5	1	6	8	3	11	9	10	12	2	4	7
1	2	3	4	5	6	7	8	9	10	11	12

HEAD

FAIRWAY

BENTGRASS NURSERY, LOS COYOTES COUNTRY CLUB