Project: Evaluation of Insecticides for Control of Black Turfgrass Ataenius Grubs

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Summary: In a replicated field trial at Los Coyotes Country Club, Buena Park, CA, the insecticides halofenozide, imidacloprid and acephate were tested for control of black turfgrass ataenius grubs. Treatments performing better than the non-treated control included the high rate of Mach 2 G (69.6 oz/1000 square feet), the mid-rate of Mach 2 SC (2.2 oz/1000 square feet) and Merit 75 WSP (0.15 oz/1000 square feet). The highly clumped nature of ataenius infestations, and the relatively low population levels made separation of other treatment effects impossible. However, trends (non-significant) indicate that Pinpoint 15 G (acephate) and the 3.0 oz rate of Mach 2 SC also performed quite well.

A strong rate response for Mach 2 G was observed. Surprisingly, there was only a weak rate response for Mach 2 SC.

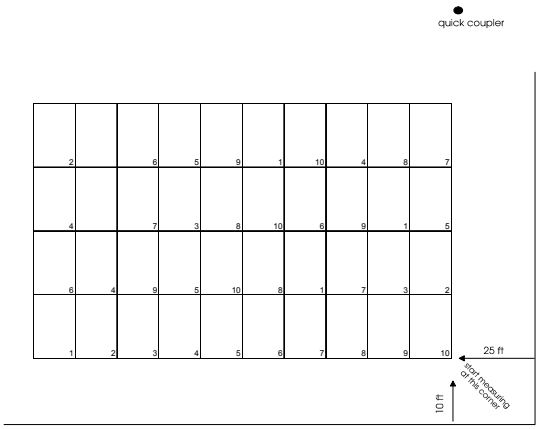
All products showed some level of curative activity on grub populations that were present at the time of application. In addition, residual activity of up to two months was observed for Mach 2 SC (2.2 oz rate) and Mach 2 G (69.6 oz rate).

Materials and Methods:

Location: Research plots were located on a bentgrass nursery (variety Crenshaw) maintained under greens conditions at Los Coyotes Country Club, Buena Park, CA.

Experimental design and application: Plots measured 5 feet by 10 feet and treatments were replicated four times (for all Mach 2 treatments), and three times (for Orthene and Pinpoint treatments) in a randomized design (Figure 1).

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



Liquid formulations 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 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 10 times prior to charging with compressed CO_2. Spray lines were purged with CO_2 and then water prior to changing treatments.

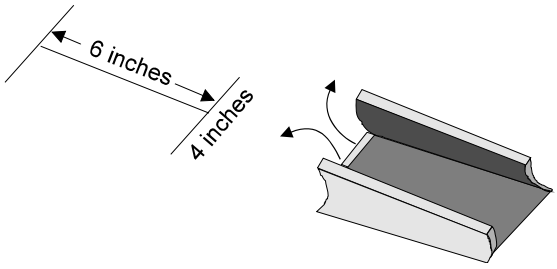
Granular formulations were applied via shaking the contents of a Nalgene bottle evenly on each plot. For Mach 2 G applications, the bottle was outfitted with a cap drilled with 6 holes, 12/64" in diameter. For Pinpoint applications, the bottle was outfitted with a cap drilled with 3 holes, 7/64" in diameter.

Irrigation was applied after treatment with 1/10 inch of water delivered to plots.

Treatments: Treatments are listed below. Applications were initiated on 8/4/97, or two weeks after black turfgrass ataenius adult populations had peaked in black light trap samples from Los Coyotes Country Club. This application timing was adopted to insure that the initial application was made during a peak egg laying period.

Trt #	Product	AI	Rate/1000 sq ft	Application Timing	Application Dates
1	Non-treated				
2	Pinpoint 15 G	acephate	12 oz	2 bi-weekly applications	8/4, 8/18
3	Orthene TTO	acephate	2.4 oz	2 biweekly applications	8/4, 8/18
4	Mach 2 SC	halofenozide	1.5 oz	1 application at egg lay	8/4
5	Mach 2 SC	halofenozide	2.2 oz	1 application at egg lay	8/4
6	Mach 2 SC	halofenozide	3.0 oz	1 application at egg lay	8/4
7	Mach 2 G	halofenozide	24.5 oz	1 application at egg lay	8/4
8	Mach 2 G	halofenozide	36.8 oz	1 application at egg lay	8/4
9	Mach 2 G	halofenozide	69.6 oz	1 application at egg lay	8/4
10	Merit 75 WSP	imidacloprid	0.15 oz	1 application at egg lay	8/4

Ratings and Data Analysis: 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 damaged 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.

Evaluations were conducted before application, on 8/18/97, 8/26/97 and 9/24/97. Analysis of the pre-count data revealed that grub populations were heavily clumped, with significant differences ($P < 0.10$) in population densities (Table 2, 8/4/97 data). To overcome this bias, it was determined that data would be best analyzed by comparing the number of grubs present in each plot on each post-treatment date, vs. the number that were present before treatment:

$$\%control = 100 - [TotalBTApresent(date1) / TotalBTApresent(precount)]$$

Data was subjected to analysis of variance, and treatment means were separated using Fisher's LSD, where $P<0.10$ (data print-out attached). Prior to conducting analysis of variance for percent control values, data was transformed using the arcsine(square root[percent control value]) transformation.

Results and Discussion:

Black turfgrass ataenius biology: Because there are up to five generations of the BTA in Southern California (Gelernter, 1996), life stages and generations frequently overlap. This was the case for this study, where small (1/8" long or less), large (> 1/8" long) and pupal forms of the BTA were present on all sampling dates (Table 2).

Efficacy: Black turfgrass ataenius grubs displayed a typical clumped distribution (see 8/4/97 pre-count data), with significant differences among treatments, even on the pre-count date. For this reason, absolute counts of BTA larvae and pupae were probably not the best representation of product performance, as borne out by the lack of any pattern of performance exhibited by this data (Table 2). However, because BTA grubs and pupae are basically non-mobile, we are better able to

assess product performance by evaluating the populations in each plot over time, versus the initial (pre-count) population (Table 1, Figures 2 -5).

The best performance was delivered by Mach 2 SC (2.2 oz/1000 sq ft) and Mach 2 G (68.7 oz/1000 sq ft) (Figure 2). The somewhat inferior performance of Mach 2 SC at a higher rate (3.0 oz/1000 sq ft) is curious (Figure 3), and was not paralleled in the performance of the granular formulation, which showed a classic rate response (Figure 4). The best performing Mach 2 treatments provided control that was comparable to, or even better than (although not significantly) than the commercial standard, Merit 75 WSP. Since Merit is a highly regarded product for control of white grubs, these results put Mach 2 in good company.

Orthene and Pinpoint both provided control of black turfgrass ataenius grubs that was numerically (although not statistically) superior to that in the non-treated control plots (Figure 5). The heavy clumping of the BTA population, and the relatively low population densities contributed to this lack of our ability to separate among treatments.

The high rate of Mach 2 G (69.6 oz/1000 sq ft) demonstrated some level of curative activity, as indicated by the significant decline in the number of grubs present in the two weeks between the pre-count and on 8/18/97, the first post-treatment count (Table 1).

Residual activity of up to two months was demonstrated by Mach 2 SC (2.2 oz/1000 square feet) and Mach 2 G (69.6 oz/1000 sq ft). This is an important performance feature, since the residual control offered by Merit is believed to be one of that product's most attractive features.

Turf Quality Ratings: The relatively low black turfgrass ataenius grub populations resulted in no visual damage to turf. Turf quality throughout the plot area was rated between 7 and 8 throughout the trial, where 0 = worst possible turf and 9 = best possible turf.

Soil Tests: Soil tests, including nutritional and moisture analyses, were performed by Brookside Laboratories, New Knoxville, OH. All parameters appeared to be normal. Test results are attached.

Thatch thickness: Thatch thickness was measured in three locations on 9/3/97, with measurements of 5/8", 6/8", and 5/8". All three of these measurements exceeded the requirement for a minimum of 1/2" of thatch.

Soil moisture: Soil moisture was rated as a "1" on each evaluation date.

Table 1. Percent control of black turfgrass ataenius larval and pupal populations. Percent control (values below are non-transformed) was determined by comparing the total number of BTA larvae and pupae present on a given date and given treatment with the number present for that treatment at the pre-count (see equation below). Values followed by the same letter are not significantly different (Fisher's LSD, P<0.10). Values highlighted in yellow were significantly different than the non-treated control.

$$\%control = 100 - [TotalBTApresent(date1) \,/\, TotalBTApresent(precount)]$$

	PERCENT BTA CONTROL						
Trt #	**Treatment**	**8/18/97**		**8/25/97**		**9/24/97**	
1	Non-treated control	29.4	ab	32.6	a	35.9	a
2	Pinpoint 15G, 12 oz	61.1	bc	*		66.7	abc
3	Orthene TTO, 2.4 oz	33.3	ab	*		44.4	ab
4	Mach 2 SC, 1.5 oz	30.6	ab	43.1	ab	45.8	ab
5	Mach 2 SC, 2.2 oz	59.4	bc	66.7	bc	75.0	bc
6	Mach 2 SC, 3.0 oz	58.3	bc	56.9	abc	66.7	abc
7	Mach 2 G, 24.5 oz	11.7	a	33.8	a	41.7	a
8	Mach 2 G, 36.8 oz	46.1	b	55.1	abc	58.3	abc
9	Mach 2 G, 69.6 oz	68.7	c	77.4	c	82.3	c
10	Merit 75 WSP, 0.15 oz	50.0	bc	66.0	bc	58.3	abc

* data not taken for these treatments on 8/25/97

Figure 2. Efficacy of Mach 2 treatments vs. the non-treated check and Merit 75 WSP for control of black turfgrass ataenius grubs. Los Coyotes Country Club, Buena Park, CA. Treatment descriptions corresponding to each treatment number appear in Table 1 (above).

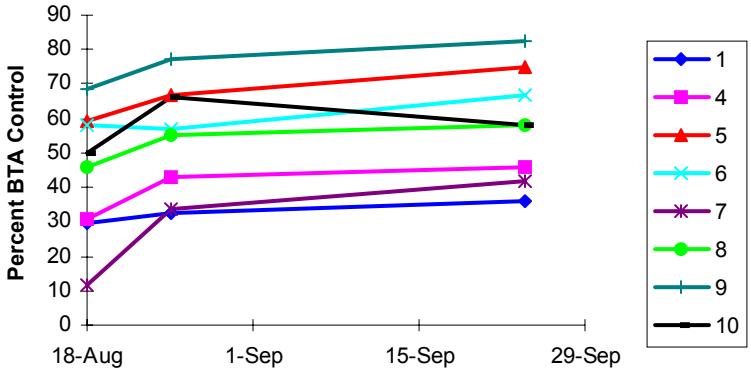


Figure 3. Efficacy of Mach 2 SC treatments vs. the non-treated check and Merit 75 WSP for control of black turfgrass ataenius grubs. Los Coyotes Country Club, Buena Park, CA. Treatment descriptions corresponding to each treatment number appear in Table 1 (above).

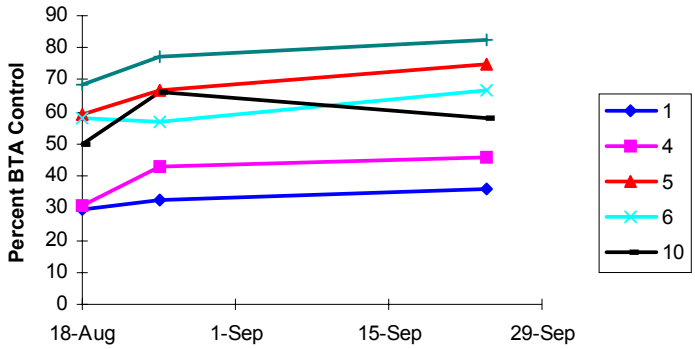


Figure 4. Efficacy of Mach 2 G treatments vs. the non-treated check and Merit 75 WSP for control of black turfgrass ataenius grubs. Los Coyotes Country Club, Buena Park, CA. Treatment descriptions corresponding to each treatment number appear in Table 1 (above).

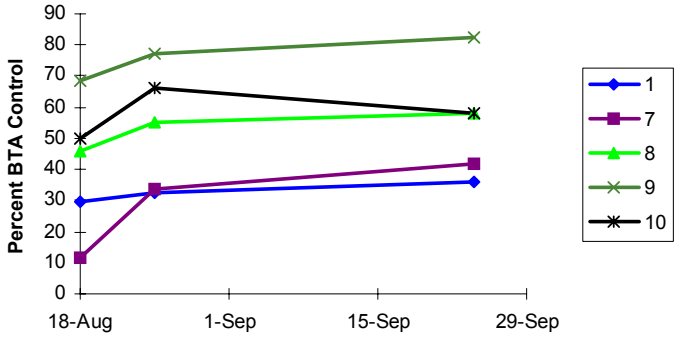


Figure 5. Efficacy of Orthene and Pinpoint treatments vs. the non-treated check and Merit 75 WSP for control of black turfgrass ataenius grubs. Los Coyotes Country Club, Buena Park, CA. Treatment descriptions corresponding to each treatment number appear in Table 1 (above).

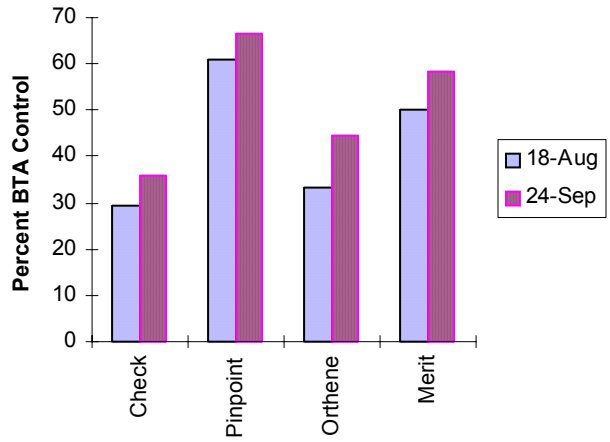


Table 2. Black turfgrass ataenius larval and pupal population counts. Values represent the mean number of BTA present per sample. Total BTA represents the mean sum of small BTA, large BTA and BTA pupae per sample. Values followed by the same letter are not significantly different (Fisher's LSD, P<0.10). Values highlighted in yellow were significantly different than the non-treated control.

	August 4, 1997 (precount)							
Trt	**small BTA**		**large BTA**		**BTA pupae**		**Total BTA**	
1	0.17	a	2.17	ab	0.33	a	2.67	ab
2	0.67	a	1.11	abc	0.22	a	2.00	ab
3	0.78	a	0.11	c	0.56	a	1.44	ab
4	0.50	a	0.42	c	0.17	a	1.08	b
5	0.58	a	0.67	bc	0.67	a	1.92	ab
6	0.67	a	0.92	abc	0.42	a	2.00	ab
7	0.67	a	0.25	c	0.17	a	1.08	b
8	1.17	a	2.08	ab	0.33	a	3.58	a
9	0.58	a	2.42	a	0.75	a	3.75	a
10	0.42	a	2.17	ab	0.75	a	3.42	a

	August 18, 1997							
	small BTA		**large BTA**		**BTA pupae**		**Total BTA**	
1	0.17	ab	0.67	ns	0.33	abc	1.17	a
2	0.11	ab	0.22	ns	0.11	bc	0.44	a
3	0.00	b	0.11	ns	0.22	bc	0.33	a
4	0.25	ab	0.58	ns	0.83	a	1.67	a
5	0.33	a	0.67	ns	0.42	abc	1.42	a
6	0	b	0.67	ns	0.08	c	0.75	a
7	0.17	ab	0.25	ns	0.50	abc	0.92	a
8	0.42	a	0.08	ns	0.50	abc	1.00	a
9	0.00	b	0.42	ns	0.25	bc	0.67	a
10	0.17	ab	0.00	ns	0.67	ab	0.83	a

Table 2 (continued). Black turfgrass ataenius larval and pupal population counts. Values represent the mean number of BTA present per sample. Total BTA represents the mean sum of small BTA, large BTA and BTA pupae per sample. Values followed by the same letter are not significantly different (Fisher's LSD, P<0.10). Values highlighted in yellow were significantly different than the non-treated control.

	August 25, 1997							
	small BTA		large BTA		BTA pupae		Total BTA	
1	0.08	a	0.75	a	0.42	ns	1.25	a
2	*		*		*		*	
3	*		*		*		*	
4	0.08	a	0.08	b	0.50	ns	0.67	b
5	0.17	a	0.00	b	0.50	ns	0.67	b
6	0.00	a	0.00	b	0.33	ns	0.33	b
7	0.17	a	0.00	b	0.17	ns	0.33	b
8	0.17	a	0.00	b	0.17	ns	0.33	b
9	0.00	a	0.00	b	0.33	ns	0.33	b
10	0.00	a	0.00	b	0.17	ns	0.17	b

* data not taken for these treatments on 8/25/97

	September 24, 1997							
	small BTA		large BTA		BTA pupae		Total BTA	
1	1.00	a	0.25	a	0.08	a	1.33	a
2	0.22	b	0.00	b	0.00	a	0.22	a
3	0.00	b	0.00	b	0.00	a	0.00	a
4	0.00	b	0.00	b	0.08	a	0.08	a
5	0.00	b	0.00	b	0.00	a	0.00	a
6	0.00	b	0.00	b	0.00	a	0.00	a
7	0.00	b	0.00	b	0.00	a	0.00	a
8	0.00	b	0.00	b	0.00	a	0.00	a
9	0.00	b	0.00	b	0.08	a	0.08	a
10	0.00	b	0.00	b	0.00	a	0.00	a

References

Gelernter, W.D. 1996. Black Turfgrass Ataenius Management in California. California Fairways. January/February 1996.