Evaluation of Insecticides for Curative Control of Black Cutworms on Golf Course Turf

Principal Investigators: Wendy Gelernter, Ph.D. and Larry J. Stowell, Ph.D.

Cooperator: Bruce Duenow, La Jolla Country Club

Sponsors: Bayer, Zeneca, Novartis

Summary: In a replicated field trial on a bentgrass nursery at La Jolla Country Club, La Jolla, CA, a single curative treatment of various insecticides was evaluated for control of black cutworm larvae. Key results include:

- The best performing treatments included pyrethroid insecticides (Tempo, Scimitar, Talstar) and diazinon. A combination of Proclaim (emamectin benzoate) plus Avid (avermectin) also provided very good control.

- The experimental compound thiamethoxam (25 WG formulation) performed better than the non-treated check at the highest rate tested (0.3 oz/1000 sq ft), but not as well as the top performing products described above. At the two lower rates (0.15 oz and 0.20 oz/1000 sq ft), thiamethoxam did not perform as well as at the high rate.

- The addition of Proclaim to thiamethoxam somewhat improved the performance of thiamethoxam. In contrast, addition of Avid to thiamethoxam did not significantly improve the performance of thiamethoxam.

- The granular formulation of thiamethoxam performed significantly worse than a comparable rate of the WG formulation (0.0725 oz ai/1000 square feet), and was statistically indistinguishable from the check. This difference in performance between sprayable and granular formulations is typical for many insecticides, especially when foliar feeding insects such as black cutworms are involved.

Materials and Methods:

Location: Research plots were located on a bentgrass nursery at La Jolla Country Club, La Jolla, CA. Turf was mowed slightly higher than greens height (1/4") to encourage black cutworm infestations.

Experimental design and application: Plots measuring 5 feet by 10 feet were replicated four times in a randomized design (Figure 1). Sprayable treatments were applied with a CO_2 backpack sprayer equipped with 8008 VS flat fan nozzles and delivering 1.7 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 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 Tempo 0.1 G applications) or with seven 11/64" holes drilled in the top (for all other granular applications). Mowing and application was delayed for 24 hours following application of insecticides.

Treatments: Treatments are listed in Table 1 below. A single curative application of each product was made on 9/10/98, when black cutworm populations reached an average of 4 larvae per 8 square feet.

Evaluations: Evaluations were made 4 and 11 days after application for all twenty treatments. Additional evaluations, made at 18 and 25 days after application, were conducted for treatments 12-20, at the request of the sponsoring company. Black cutworm populations were quantified by counting the number of larvae that appeared following application of an irritant solution of Lemon Joy applied through a hose end sprayer (Gilmour Insecticide and Fertilizer sprayer) that delivered ½oz Lemon Joy per gallon of spray

solution. To achieve this delivery rate, the hose end sprayer dial was set at 1 tablespoon, and the soap solution in the hose end sprayer consisted of a mixture of 2 parts water to 1 part Lemon Joy. The number of cutworms that appeared within 5 minutes of application of the irritant solution per 8 square feet of turf surface in each plot were counted and recorded using a rectangle of aluminum screen frame measuring 2 feet by 4 feet to mark the counting area. To encourage optimal larval counts, turf was pre-irrigated with approximately 1/10" water prior to application of the irritant solution. 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 cutworms might suffer following exposure to the soap irritant solution.

Results and Discussion:

Mixing and handling: All products handled well, with the exception of the CGA 293,343 granule, whose density was insufficient to prevent significant drift at wind speeds of 2-3 mph.

Phytotoxicity: None of the products tested caused any phytotoxicity, with the exception of Tempo 0.1 G, a fertilizer based granule, which caused development of many small to medium sized (1 - 3 inches in diameter), irregular shaped patches of browned turf. Because none of the other Tempo formulations caused any turf damage, it is likely that it was not the active ingredient, but instead some other component of the granule itself -- either the fertilizer or the carrier -- that was responsible for the observed damage. This damage was first noted 4 days after treatment, and was again evident 7 days after treatment. By 11 days after treatment, only a few damaged areas remained. The plots treated with Tempo 0.1 G also had darker green turf for the duration of the trial, as would be expected following an application of nitrogen fertilizer.

Efficacy: The best performing treatments included pyrethroid insecticides (Tempo, Scimitar, Talstar) and diazinon. A combination of Proclaim plus Avid also performed very well. In a market currently dominated by the organophosphate, chlorpyrifos (which may encounter regulatory scrutiny under the Food Quality Protection Act), the registration of additional effective insecticides with new modes of action is welcome progress.

It is interesting to note that a single application of many of the products mentioned above provided good control of black cutworm larvae for up to four weeks. Since young cutworm larvae were present in check plots throughout the study, this indicates that newly hatched larvae were suffering mortality from insecticide applications made up to four weeks earlier. This suggests that there is some residual activity for many of the treatments, which prevented re-infestation of treated plots by newly hatched larvae and by larvae migrating into plots from untreated areas of turf.

The experimental compound thiamethoxam (WG formulation) performed better than the non-treated check at the highest rate tested, but not as well as the top performing products. At the two lower rates, thiamethoxam did not perform as well as at the high rate.

The addition of Proclaim to thiamethoxam somewhat improved the performance of thiamethoxam on the 9/14 and 9/21 rating dates. In contrast, addition of Avid to thiamethoxam did not significantly improve the performance of thiamethoxam.

The granular formulation of thiamethoxam performed significantly worse than a comparable rate of the WG formulation (0.0725 oz ai/1000 square feet), and was statistically indistinguishable from the check. This difference in performance between sprayable and granular formulations is typical for many insecticides, especially when foliar feeding insects are involved.

Table 1. Black cutworm counts, 4, 11, 18 and 25 days after treatment. La Jolla Country Club, La Jolla CA. Treatments were made to a bentgrass green with populations of black cutworm on 9/10/98. Counts were made using an irritant soap solution to disclose black cutworm larvae. Counts reflect the mean number of cutworms (4 replicates) found in a 2 X 4-foot area. 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 (P<0.10).

				Mean # black cutworm larvae/8 sq. ft			
	Treatment	**Active Ingredient**	**Rate/1000 sq. ft**	**9/14/98**	**9/21/98**	**9/28/98**	**10/5/98**
1	Tempo 0.1 G	cyfluthrin	4.6 lb	0.0 a	0.25 ab	n/c	n/c
2	Tempo 0.2 G	cyfluthrin	2.3 lb	0.0 a	0.0 a	n/c	n/c
3	Tempo 20 WP	cyfluthrin	0.37 oz	0.0 a	0.0 a	n/c	n/c
4	Tempo Ultra	beta cyfluthrin	0.2 oz	0.0 a	0.0 a	n/c	n/c
5	Talstar G	bifenthrin	2.3 lb	0.0 a	0.0 a	n/c	n/c
6	Scimitar 10 WP	λ cyhalothrin	0.11 oz	0.0 a	0.0 a	n/c	n/c
7	Scimitar 10 WP	λ cyhalothrin	0.22 oz	0.0 a	0.0 a	n/c	n/c
8	Scimitar 10 GC	λ cyhalothrin	0.11 oz	0.0 a	0.0 a	n/c	n/c
9	Scimitar 10 GC	λ cyhalothrin	0.22 oz	0.0 a	0.25 ab	n/c	n/c
10	Scimitar 25 GC	λ cyhalothrin	0.05 oz	0.0 a	0.0 a	n/c	n/c
11	Scimitar 25 GC	λ cyhalothrin	0.10 oz	0.0 a	0.0 a	n/c	n/c
12	CGA 293,343 25 WG	thiamethoxam	0.2 oz	2.0 d	4.25 de	1.5 ab	1.0 a
13	CGA 293,343 25 WG	thiamethoxam	0.3 oz	0.5 ab	2.75 cd	1.25 ab	1.25 ab
14	CGA 293,343 25 WG	thiamethoxam	0.15 oz	1.0 bc	4.25 de	2.0 ab	1.5 ab
15	CGA 293,343 0.22 G	thiamethoxam	33 oz	1.5 cd	5.0 e	1.0 a	2.25 ab
16	CGA 293,343 25 WG + Proclaim 5SG	thiamethoxam + emamectin benzoate	0.15 + 0.07 oz	0.25 ab	2.0 bc	0.50 a	1.5 ab
17	CGA 293,343 25 WG + Avid 0.15 EC	thiamethoxam + abamectin	0.15 + 0.18 oz	0.75 abc	4.25 de	0.25 a	2.25 ab
18	Proclaim 5SG + Avid 0.15 EC	emamectin benzoate + abamectin	0.07 + 0.18 oz	0.25 ab	1.75 abc	0.75 a	1.0 a
19	Diazinon AG 600	diazinon	2.5 oz	0.5 ab	0.0 a	0.25 a	0.75 a
20	Non-treated control			2.0d	5.0 e	3.0 b	2.75 b

n/c: data not collected on this date

Figure 1. Black cutworm study plot plan. Each plot measured 5 X 10 feet.

19	15	6	16	11	14	2	18	7	10	4	13	3	20	17	5	1	9	8	12
4	8	10	5	12	20	13	1	17	3	9	15	14	2	18	7	11	19	6	16
17	6	14	9	18	4	12	7	16	10	20	11	19	1	15	2	13	3	8	5
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	18	20