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Black Cutworm Sampling and Control Programs for 1999

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Bottom line: Larvae of the black cutworm are the dominant insect pests of turf in much of the United States. The recent introduction of several new insecticides has allowed more control options for this pests than in the past. However, to use these products most effectively and to avoid unnecessary insecticide applications, a good understanding of cutworm biology and implementation of an insect sampling plan are required.

The black cutworm: the most frequently treated insect pest on golf course greens

Caterpillars (larvae) of the black cutworm, *Agrotis ipsilon,* are frequent inhabitants of golf course greens between May and November (Figures 1 and 2).

Figure 1. Caterpillars (larvae) are the damaging stage of the black cutworm and can vary in color from dark gray to black. They range in size from 1/8 inch long (when newly hatched) to almost 2 inches long when they are fully grown. It takes 20-40 days from the time the egg hatches for the caterpillar to reach its full size.

Figure 2. Moths (adults) of the black cutworm do not cause damage to turf, and instead only feed on flower nectar. They are night-flying moths with thick bodies and dark colored wings with a wingspan as wide as 1¾ inches. In the center of each forewing, a characteristic, dagger-shaped pattern (see white arrows) can be seen. Female moths lay their eggs on the tips of turf blades or weeds. Caterpillars hatch from eggs a few days later, beginning the cycle all over again.

Types of damage caused by black cutworms

Although cutworms are present for much of the year, they cause problems only under certain conditions. For this reason, the mere presence of cutworms may not be sufficient to warrant an insecticide application, as discussed below.

For much of their lifetime, cutworm caterpillars wander along the surface of the turf, feeding on a grass blade here, a grass blade there, with no obvious signs of feeding damage resulting. But as they grow larger, the larvae change their roving life style and become home-bodies instead, by digging small holes in the soil or thatch (or by occupying aerification holes), and focusing their feeding activities (which occur primarily at night) in the immediate area around their burrows. Larger larvae can eat the equivalent of a handful of foliage in a single evening. This creates areas of dead turf right around the cutworm burrow that resemble ball marks (Figure 3).

Figure 3. Typical damage caused by black cutworm larvae. The caterpillars will either dig their own burrows, or can occupy holes made by aerifiers or by spikes.

Black cutworm larvae can also be responsible for **indirect damage** – damage caused as a result of their presence, but not necessarily due to their feeding. For example, birds sometimes cause damage to greens in the search for caterpillars such as cutworms. And we have observed that in some areas, increased wasp activity may be due to the presence of cutworm larvae. Wasps such as yellow jackets and the golden polistes actively feed on cutworms, as illustrated in Figure 4. But be careful -- indirect damage can be a tricky thing to interpret, since cutworms are only one of the many causes of increased bird and wasp activity. For this

reason, you should always make sure that cutworms are actually present before assuming that they are the culprits. A sampling procedure such as the one described below can help determine whether cutworms are present, and in what densities.

Figure 4. Yellow jacket feeding on cutworm larva. Both yellow jackets and the closely related golden polistes wasp impart painful stings to humans, which can make them pests on golf courses. They also gather caterpillars such as cutworms, and then proceed to skin and chew them, prior to feeding them to immature wasp larvae.

Why sample for cutworms?

There are a few good reasons to consider using the relatively simple cutworm sampling procedure described below. First, before treating for cutworms it's necessary to establish that cutworms are really present. Without sampling, determining the presence of cutworms can be a bit tricky, since the damage symptoms that they cause can also be the result of other problems – from ball marks that look like cutworm feeding holes, to ataenius beetles that are as attractive to birds as cutworm caterpillars are. A second reason to sample is to find out how effective an insecticide application has been. By sampling before spraying, and then sampling again 2-3 days after spraying, you can determine whether cutworm populations are going up, down, or staying the same. A third reason for sampling that is often cited in textbooks is to determine whether there are high enough numbers of pests present (sometimes called the **economic threshold**) to warrant insecticide applications. However, even though this approach sounds logical, it turns out that there is no magic threshold number available to help make this decision. This is because the threshold value can vary widely from golf course to golf course, and from week to week. Sometimes, just a few cutworms per square yard can result in unacceptable damage; at other times, when cutworms are feeding more randomly, no damage will be seen even though there are 5 or more cutworms per square yard. This is why we believe that the absolute numbers of cutworms detected via sampling may not be a very valuable number for making application decisions. Sampling is useful for helping you determine whether turf damage is caused by cutworms or some other source. But the timing of cutworm applications will probably be based more on the level of cutworm damage that is tolerable at your course than on the actual numbers of caterpillars that are present.

Cutworm sampling procedure

We are lucky to have a very effective, fairly simple sampling procedure for black cutworms and several other insect pests. It relies on a strange behavioral trait of many insects – they become extremely irritated when doused with a soapy solution. This causes them to emerge from their feeding holes in the thatch and the soil, which in turn allows them to be easily counted.

For many years, superintendents have relied on the use of a bucket or watering can to deliver the soap solution (Figure 5), a method which works just fine, but can be time consuming if several areas must be sampled. To improve your efficiency, we suggest that you use a hose-end sprayer to deliver the soap solution, a modification that allows you to sample in several locations per green, or on several greens, in a very short time period.

Figure 5. Use of watering can to deliver cutworm irritant solution (soapy water). Note the use of a square yard sampling square (3 feet by 3 feet) made of PVC pipe.

Figure 6. Use of a hose-end sprayer to deliver cutworm irritant solution results in significant time savings.

<u>Cutworm sampling procedure:</u>

1. Beginning in late Spring (usually around May), keep an eye out for signs of cutworms: feeding holes (Figure 3), bird activity, yellow jacket activity, or dew trails (by walking over the surface of the turf at night

and early morning, cutworms make a visible trail when there is dew). Use signs of early cutworm damage as a trigger date for beginning your cutworm sampling program.

2. Prepare at least one gallon of a solution of Lemon Joy dishwashing liquid (this brand appears to work well, without damaging turf) that contains two parts water to 1 part Lemon Joy. If you plan to prepare one gallon of solution, you would need 86 oz of water and 42 oz of Lemon Joy. It is necessary to dilute the Lemon Joy in this way BEFORE adding it to a hose-end sprayer because it is too thick for spraying and mixing in its unaltered state.
3. Obtain a hose-end sprayer such as the Gilmour Insecticide and Fertilizer sprayer (Figure 6). When using the 2:1 solution of Lemon Joy described in #2 above, set the dial of the Gilmour sprayer to 1 tablespoon.
4. Spray the soap solution onto an area of about 1 square yard (3 feet by 3 feet). You can construct a sampling square out of PVC pipe or other materials to help outline the same sized area each time (Figure 5). The turf and thatch should be well drenched with the soap solution until some suds begin to appear (Figure 6).
5. Cutworms (and other insects including sod webworms, armyworms and black turfgrass ataenius adult beetles) should begin to wriggle up to the surface within 1-5 minutes. Record the date, the location, and the number of cutworms per square yard. Sample at least 3 areas per green.
6. If damage is unacceptable, and if the presence of cutworms has been confirmed, consider one of the control strategies reviewed below.

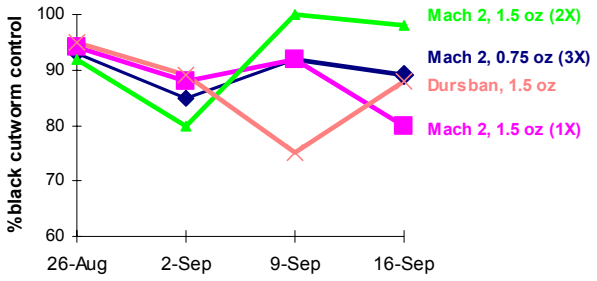
Cutworm control products

Although cutworms can be a headache, they are relatively easy to control. This is partly because their habit of feeding near the surface of the turf allows us to easily detect and identify their presence. In addition, we have had two very effective products available for several years – chlorpyrifos (Dursban) and trichlorfon (Dylox, Proxol). While these products remain highly effective, the fact that they are classified as organophosphates may make them subject to increased regulatory scrutiny under the EPA's Food Quality Protection Act. Luckily, several new insect control products have been introduced, or will be introduced soon, and we have had the opportunity to test many of them. These products are listed below, organized on the basis of the chemical class to which they belong.

Pyrethroids: Pyrethroid insecticides (such as Deltagard, Scimitar, Talstar and Tempo) have not been used heavily on golf courses in the past, but are currently being promoted as good alternatives to organophosphate (OP) products such as Dursban and Dylox. Like the OPs, pyrethroids are conventional insecticides that kill insects within hours of contact by attacking their nervous systems. However, pyrethroids are under much less regulatory scrutiny than OPs. In our tests, the pyrethroid insecticides all performed extremely well against cutworms, with no real differences in performance among them.

Halofenozide (Mach 2): Based on a unique, low toxicity molecule known as halofenozide, Mach 2 is highly active on both caterpillar and grub pests, killing them by interfering with the molting (shedding of insect skin) process. This product must be eaten by the insect to be active, and will take 2 –3 days to kill the target pest. In addition to its increased safety, Mach 2 has the real benefit of being active not just on caterpillar pests such as cutworms, but also on the larvae (grub) stages of beetle pests such as Japanese beetle, black turfgrass ataenius and masked chafers. In our 1997 and 1998 black cutworm tests, Mach 2 performed as well as commercial standards such as Dursban (Figure 7). The performance of Mach 2 against ataenius grubs will be reviewed in an upcoming issue of *PACE Insights.* Mach 2 is registered throughout the U.S., but will not be registered in California until late 1999/early 2000.

Figure 7. Efficacy of Mach 2 SC vs. Dursban for control of black cutworm larvae, La Jolla Country Club, 1997, Bruce Duenow, cooperator. Mach 2 was applied either once (on 8/22 at 1.5 oz/1000), twice (on 8/22 and 9/5 at 1.5 oz/1000) or three times (on 8/22, 9/5 and 9/12 at 0.75 oz). Dursban was applied once on 8/22. When the data was analyzed (Fisher's LSD, $p<0.05$), Mach 2 performed as well as Dursban at all rates and application frequencies tested.



Thiamethoxam: Another low toxicity product, thiamethoxam also has activity against caterpillars and grub pests. However, in this case, the active ingredient is classified in the neonicotinid group – a group that also includes Merit (imidacloprid). Although this product has not been registered yet, Novartis hopes to see the product on the market in the near future. In our 1998 tests, this product had excellent activity on black turfgrass ataenius grubs (see upcoming *PACE Insights* for details), but had only mediocre activity on black cutworms, a result that was apparently mirrored in research trials in other parts of the U.S. For this reason, we expect that thiamethoxam will be marketed primarily

as a grub-active material.

Spinosad (Conserve): Yet another low toxicity molecule, Dow's new product, Conserve, is a unique material that is active against caterpillars, leafminers and a variety of other pests. However, it does not have activity against white grubs. Registered throughout the U.S., Conserve has been tested against black cutworms in several locations, with good results. The product works best when it is eaten by the insect, and the pest will die 1 –3 days later. Although we haven't tested this product at PACE, the positive experiences of researchers and superintendents alike indicate that this product should be considered as a component of cutworm programs.

Biologicals: Diseases of insects, such as fungi and nematodes, are marketed as biopesticides for control of both caterpillar and grub pests. Fungal products such as Troy's Naturalis (*Beauveria bassiana*) and insect pathogenic nematode products such as Ecogen's Cruiser (*Heterorhabditis bacteriophora*) and Thermo Trilogy's BioVector, BioSafe and Savior (*Steinernema carpocapsae*) are registered for use on golf courses. However, in our tests, their efficacy has been mediocre – better than treating with nothing, but not as good as that obtained with the products in Table 1 below. Under the right environmental and application conditions, these biological products can perform very well, but we haven't yet developed methods to obtain good results consistently. If you are interested in investigating the use of biologicals on your golf course, we encourage you to evaluate them under your own conditions. If you are successful, please let us know and we'll pass on the information to others.

Table 1. A summary of products tested (1997-1998 by the PACE Turfgrass Research Institute) with good efficacy against black cutworm larvae

PRODUCT	ACTIVE INGREDIENT	GRUB ACTIVITY	MANU-FACTURER
Deltagard SC	deltamethrin	No	AgrEvo
Dursban Pro	chlorpyrifos	No	Dow
Dylox 80	trichlorfon	Yes	Bayer
Mach 2*	halofenozide	Yes	Rohmid
Scimitar GC	λ cyhalothrin	No	Zeneca
Talstar GC	bifenthrin	No	FMC
Tempo 20 WP	cyfluthrin	No	Bayer

*Although federally registered, Mach 2 is currently not registered in California.

Management strategies for cutworms

Effective cutworm management involves these activities:

1. Use damage assessments on greens to trigger cutworm sampling programs.
2. Confirm that cutworms are present and are the cause of the damage before treating with insecticides.
3. Rotate products among different chemical classes to avoid development of cutworm resistance to insecticides.

Overall, liquid formulations of insecticides appear to perform better than granular based products. While the reasons for this trend are not clear, better distribution of the product, and full release of the active ingredient upon application with liquids (as opposed to the slower release sometimes seen with granules) may play a role.

It is important to note that post-treatment irrigation is NOT required when cutworms are the target pests. This is because the cutworms occur in the thatch or even on the surface of the turf and irrigation may therefore wash the product down below the thatch, decreasing its effectiveness. Some manufacturers recommend delaying irrigation for 24 hours after insecticide application for this reason.

Some publications recommend applying cutworm products as late in the day as possible, since cutworms are most active at night, and since ultraviolet inactivation of insecticides by sunlight can be decreased this way. While this is surely the case, the products listed in Table 1 are so effective that even early morning applications provided excellent control in our tests. Thus, while applications late in the day may improve control, it may not be necessary to go out of your way to meet this particular requirement.

At this point, there are few cultural methods that have been developed to combat cutworms. One exception comes from research conducted by Williamson and Potter (1997) who recommend that clipping removal and treatment of surrounds (at least a boom's width around the green), as well as greens may improve cutworm control. This is based on their finding that cutworm eggs are usually laid on the tips of grass blades, and are therefore regularly removed from frequently mowed greens. However, if clippings aren't removed, or if higher mown grass is not treated, cutworms can migrate onto nearby greens.

References

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Williamson, R.C. and D. A. Potter. 1997. Oviposition of black cutworm on creeping bentgrass putting greens and removal of eggs by mowing. *Journal of Economic Entomology.* 90:590-94.