FEATURE ARTICLE

Ranking the Grub Insecticides

Daniel A. Potter

Every year, turf entomologists employed by universities and some private companies conduct dozens of independent research trials to evaluate the performance of new insecticides against the old standbys. Pesticide manufacturers must submit efficacy data—that is, proof that a new insecticide is effective—as part of EPA's registration process. The manufacturer usually pays a testing fee, called a grant-in-aid, to the university. Part or all of these funds can be used by the researcher to pay student assistants, purchase equipment, or otherwise support their research. Many extension turf specialists also conduct efficacy trials so that they can make informed recommendations regarding product performance. Scientists who do such trials often publish their results in *Arthropod Management Tests* (formerly *Insecticide and Acaricide Tests*), a hefty, soft-cover volume published annually by the Entomological Society of America.

As a turf entomologist I'm often asked which grub insecticide works the best. Even in my own trials, however, insecticides don't always perform consistently. Thatch thickness, soil moisture, formulation, application method, irrigation, target grub species, and other factors all can affect insecticide performance. What works best in the clay soils of Kentucky may not work as well in the sandy soils of Massachusetts. Relatively small differences in "% control" usually aren't meaningful. The best products are those that can be relied upon to give consistently good results.

Dr. David Shetlar, the "BugDoc" at The Ohio State University, performs a valuable service by periodically compiling data from *Arthropod Management Tests* into summary tables that facilitate comparisons of different products' performance across a large number of tests. The accompanying tables, provided by Dr. Shetlar, will be of interest to turf managers. Table 1 shows the efficacy of most of the insecticides marketed for grub control in the past 25 years. Some products that have been withdrawn from the market are included as a frame of reference. **The last column, percentage of tests in which the insecticide provided relatively poor (less than 70%) control, provides an index of reliability.**

Note that **two preventive insecticides, Merit® and MACH2®, both registered during the 1990s, have been consistently strong performers. Meridian®, a new thianicotinyl insecticide (registration expected in early 2001), joins the ranks of these highly effective preventives.** The remaining synthetic insecticides on the list are all short-residual organophosphates or carbamates, used for curative control when grubs are present. **Of the products still registered, Dylox® has been the most consistent performer for curative control. Of the nematode-based products, those containing *Heterorhabditis bacteriophora* have been more efficacious than those with *Steinnernema glaseri* or *S. carpocapsae,* but none of the nematodes has been as consistent as the synthetic insecticides.** Note, too, that chlorpyrifos (Dursban®) has never been a premier product for white grub control, mainly because of the tendency for its residues to be bound in thatch. **Recent EPA restrictions on Dursban® reduce our options for controlling surface-feeding pests, but won't have a big impact on grub control.**

Table 2 shows how the timing of application affects performance of preventive grub insecticides. Trichlorfon (Dylox® or Proxol®)—a fast-acting curative—is included for comparison. **All three of the preventives provide a broad application window from mid to late May until egg hatch in late July or early August.** Efficacy begins to drop in mid-August, as grubs grow larger. Although MACH2® is the only preventive that has also been marketed for early curative control, the data suggest that both Merit® and Meridian® provide comparable efficacy against first and second instars. **Late curative or "rescue" treatments applied from mid-September onward, or after damage appears, tend to provide only partial control at best.** None of the insecticides are fast-acting enough against large grubs to discourage skunks and other predatory varmints once they have started digging.

Optimal timing for preventive treatments is during the month or so before egg hatch. This treatment window generally is early June to mid-July in the transition zone, or about 2 weeks later in more northern states. Regardless of the product, curative insecticides work best if applied soon after egg hatch, when grubs are still small.

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Table 1. Ranked Efficacy of White Grub Insecticides: 1976–1999[a]

Insecticide	Rate (lb ai/ac)	Average (% control)	Number of tests	Range (% control)	% of Tests Below 70%
Thiamethoxam[b] (= Meridian®)	0.2	99.3	17	94–100	0
Halofenozide (= MACH2®)	1.5	95.4	50	10–100	6
Imidacloprid (= Merit®)	0.3	93.7	58	58–100	7
Isazofos (= Triumph®)[c]	2.0	88.8	69	46–100	10
Isofenphos (= Oftanol®)[c]	2.0	82.3	85	38–100	19
Bendiocarb (= Fican®, Turcam®)[c]	3.0	82.3	30	0–100	13
Ethoprop (= Mocap®)	5.0	76.7	38	48–97	34
Trichlorfon (= Dylox®, Proxol®)	8.0	77.4	89	0–98	20
Carbaryl (= Sevin®)	8.0	74.3	40	13–100	37
Fonofos (= Crusade®, Mainstay®)[c]	4.0	70.8	21	8–100	29
Diazinon[d,e]	4.0	69.9	19	47–99	42
	5.5	74.8	41	25–100	29
H. bacteriophora	0.5 bill	57.7	3	15–92	67
Chlorpyrifos (= Dursban®)[f]	4.0	54.6	32	0–96	59
S. glaseri	0.5 bill	31.3	14	0–71	93
S. carpocapsae	1.0 bill	21.5	10	0–61	100

[a] Data from *Insecticide and Acaricide Tests & Arthropod Management Tests,* Entomological Society of America (using masked chafers and Japanese beetle evaluations 1977–2000 and label recommended application timing). Compiled by D.J. Shetlar, October 2000.

[b] New product from Novartis, expected registration in 2001.

[c] No longer manufactured (1997–2000).

[d] Not for use on golf courses or sod farms.

[e] 5.5 lb ai./a rate reduced to 4.0 on current labels.

[f] Discontinued for residential use in 2001.

Table 2. Comparison of Grub Insecticide Efficacy by Time of Application[a]

Insecticide	Rate (lb ai/ac)	Average % Control (Tests) for Treatments Applied During				
		May	June	July	Aug. 1–16	Aug. 17–Sept. 10
Halofenozide (= MACH2®)	1.5	99.4 (5)	96.8 (18)	96.4 (12)	92.8 (12)	80.9 (20)
Imidacloprid (= Merit®)	0.3	97.7 (6)	90.8 (14)	93.1 (11)	95.1 (11)	93.7 (8)
Thiamethoxam (= Meridian®)	0.2	100.0 (3)	98.7 (10)	98.4 (5)	100.0 (3)	87.4 (3)
	0.26	97.9 (2)	100.0 (2)	98.5 (1)	100.0 (2)	100.0 (1)
Trichlorfon (= Dylox®/Proxol®)	8.0	—	—	—	91.0 (2)	82.6 (11)

[a] From studies published in *Arthropod Management Tests (1997–2000),* using Japanese beetle and masked chafer efficacy data where checks had 4+ grubs per square foot and significant results.

Compiled by D.J. Shetlar, October 2000.