1990 Entomology Research Report

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Turf Insects 1990 Adequate rain throughout the season allowed turf to quickly recover from insect injury. The number of reports of extensive injury from turf insects was down this year compared with previous years. This supports the idea that well managed turf in Michigan does not suffer from insect attack and does not need preventive insecticide appplications. Some observations and trends for specific pests are listed below.

Golf Courses

Japanese Beetle	Increased activity at some golf courses in southeast and southcentral Michigan. Damage from skunks searching for grubs was common.
European chafer	Continues to be a problem for some golf courses in Detroit and Grand Rapids area. This grub has spread to some new golf course locations in Oakland County.
Turfgrass Ataenius	Continues to be a problem for about one in five golf courses throughout Michigan. In some places extensive root damage in early July caused mowers to skid on hillsides.
Cutworms	A common midsummer problem on golf course tees and greens throughout the state.
Ants	Mostly a problem on tees and greens of golf courses with sandy soil. In some locations mounding was a problem on fairways.

Home Lawns

Chinch Bugs	Damage from chinch bugs was reduced in 1990 compared with 1988 and 1989. Chinch bug populations crashed in some areas because of Beuveria activity (a fungal pathogen of chinch bugs).
Bluegrass billbug	As in past years a small amount of billbug damage could be found nearly everywhere, but large patches of dead grass were uncommon.
Japanese beetle	Spread to new areas in Wayne and Oakland counties. More problems from Japanese beetle grubs were reported this year than in previous years.
Eurpean Chafer	Continues to spread among home lawns in the Detroit and Grand Rapids areas.

Recent Studies

- Perennial ryegrass resistance to chinch bugs USDA Beltsville. Endophyte based resistance causes ryegrass cultivars to vary from susceptible to resistant. Pennant, Regal, Citation II and Repell are among the most resistant cultivars.

- A microsporidium infection of Japanese beetle. Connecticut Ag. Exp. Station. Increased levels of infection of Japanese beetle by Ovavesicular popillae and Bacillus popillae coincided with Japanese beetle population decline.

- Billbug turf pests. Rutgers University. There are at least 4 species of billbugs in Michigan. Billbugs probably cause more damage than is realized. Turf resistance is important.

- Effect of pesticides on earthworms. University of Kentucky. One application of benomyl suppresses earthworms 60-99%, lasting 20 weeks. Diazinon, isofenfos, trichlorfon, chlorpyrifos and isazofos also cause earthworm mortality. Use of these pesticides causes an increase in thatch.

- Effect of isofenfos on beneficials. Ohio State University. Populations of springtails (Collembola) and rove beetles (Staphylinidae) were suppressed for 40 weeks. These are decomposers and predators.

The last two studies provide evidence that insecticides are destructive to beneficial insects and earthworms, and may contribute to thatch build-up. It is becoming increasingly clear that we should not use insecticides on truf unless insect pests are causing an unacceptable amount of damage.

After insect injury is correctly diagnosed, spot treatments of insecticide can be applied to infested areas rather than a general application to the entire lawn.

Recent studies suggest that insecticides are rarely needed on cool season turfgrass, yet Michigan residents continue to apply a large amount of insecticides (Table 1).

Table 1. INSECTICIDE USE ON MICHIGAN TURF*

Site	Cost of insecticide products applied in 1988 (not including labor)
Home lawns	$8,631,000.00
Lawn care companies	3,118,000.00
Golf courses	829,000.00
Hospitals	135,000.00
Schools	104,000.00
Parks	75,000.00

*1988 statewide survey by Trendfacts Research and MTF.

This discrepancy between a small need for insecticides and the large use of insecticides (over 12 million dollars of product per year) points to the need for an educational program in turfgrass integrated pest management (IPM) where thresholds and alternatives are discussed. The undesirable effects of insecticides may outweigh the benefits in many cases. This means that most of the insecticides applied to Michigan turf may be unecessary.

IMPACT OF INSECTICIDES

- Effect on wildlife
- Exposure to people and pets
- Risk to applicator
- Runoff to streams and ponds
- Risk of groundwater contamination
- Destruction of predators and parasites
- Suppression of decomposers (thatch)

Just one effect alone, the suppression of decomposers, and the resulting build-up in thatch may be a good reason to avoid unnecessary insecticide applications. However, other reasons are important too even though the effects may be difficult to see. The impact of insecticides on wildlife is an important consideration. Almost every insecticide used on turf has an impact on wildlife (Table 2). What is needed at this time is an IPM appoach to turf management that stresses growing healthy turf that is capable of compensating for insect injury. One important aspect of an IPM program is correctly diagnosing turf problems and assessing the potential for damage. Thresholds are used as guidelines for decision making. For example if more than 20 chinch bugs are found in two minutes of searching some damage may occure to those parts of the lawn. Unfortunately, the concept of thresholds is complicated by the vast differences in truf maintenance practices. Highly maintained turf has a greaty ability to recover from insect injury, while low maintenance turf may not recover as well. Research has demonstrated that irrigated turf can withstand a greater number of grubs per square foot than non-irrigated turf. The suggested threshold for Japanese beetle grubs for irrigated turf is about 30 per square foot while the threshold for non-irrigated turf is 10-15 per square foot. The different thresholds are necessary because grub injured turf is much more susceptible to water stress. One way of thinking about grub injury to turf is to compare it with new sod. New sod is similar to turf heavily injured by grubs. It will not show symptoms of stress if it receives daily irrigation. The same type of response can be expected from grub injured turf.

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One of the greatest needs at this time is better threshold information for use in turf IPM. In 1990, we initiated a project designed to define thresholds for grub injury to turf and how these thresholds are effected by irrigation practices. Part of the confusion for turf managers is that root-pruning injury may not be expressed as visible symptoms. The blades may remain green and apparently healthy even when the root system has been seriously injured by grubs. In our experiment we placed 0, 10, 20, 30, 40 or 50 grubs per square foot into bluegrass sod grown in rooting boxes at the Hancock Turf Research Center. The turf was allowed to establish for 6 weeks before grubs were added in September. The rooting boxes were pulled up in early November and the damage to turf roots quantified by measuring root strength.

In initial tests this year the rooting boxes worked well as a method of evaluating root damaged caused by grubs. A strong negative correlation was found between the number of grubs per square foot and root strength. (Figure 1B). Preliminary results suggest that grub damage to irrigated turf is not visible unless the grub infestation exceeds 30 per square foot (Figure 1B). However, injury could be expressed as patches of brown or dead turf if the turf is water stressed. No correlation was found between percent brown or dead turf and the number of grubs per square foot (Figure 1A). This is expected for irrigated turf and supports the initial hypothesis that some kind of root strength parameter is needed to evaluate grub injury.

ANT CONTROL IN TURFGRASS: 12' x 12' plots (144 ft^2) with 3' buffer strips were established in a heavily infested fairway at the Ionia Country Club in Ionia. Treatments were applied on 15 Aug. Each treatment was replicated 6 times. Plots were sprayed with a R&D hand-held boom sprayer with four 8003 nozzles at 50 psi for 66.4 s (to give 4 gal/1000 ft^2). Granular products were applied with custom-made hand shakers designed to require 3-4 trips over the entire plot area to evenly apply the amount of pre-weighed product. Ant mounds were counted just prior to insecticide treatment and once per wk for 5 wks afterwards. Ant mounds were counted if they could be seen while standing upright.

At 3 and 4 wks after treatment, only Triumph 4E significantly reduced ant mounding in comparison with the control. At 1 and 2 wks after treatment all insecticide products reduced mounding except for Pageant DF. None of the products tested were effective 5 wks after application. (Table 3)

Table 1. Insecticides commonly used on turfgrass for insect control and their effects on wildlife. This information was compiled by extension specialists at Iowa State University.

Chemical name	Some trade names	Chemical group*	Effect on wildlife
Diazinon	Diazinon, Diazol, Gardentox, Spectracide	OP	Very highly toxic to birds and fish; moderately toxic to mammals
Chlorpyrifos	Dursban, Lorsban, Eradex, Killmaster	OP	Highly toxic to birds and fish; moderate to low toxicity to mammals
Carbaryl	Devicarb, Karbaspray, Sevin	C	No observed death in birds and mammals, but some reduced populations; highly toxic to fish
Isophenphos	Oftanol	OP	Highly toxic to birds, moderate to low toxicity to mammals
Trichlorfon	Chlorophos, Dylox, Tugon	OP	Very highly to highly toxic to birds; highly to moderately toxic to mammals; increases the toxicity of Malathion
Ethoprop	Ethoprophos, Mocap, Prophos	OP	Very highly to highly toxic to birds and mammals
Tempo	Cysluthrin	P	Very highly toxic to fish; low toxicity to birds and mammals
Triumph	Izasophos	OP	Very highly toxic to fish and birds; moderate to low toxicity to mammals

* OP = organophosphate
C = carbamate
P = synthetic pyrethroid

CHINCH BUG TEST: A grid of 4' x 4' plots seperated by 1' wide buffer strips was set-up in a home lawn with a heavy infestation of chinch bugs in Okemos, Michigan. After precounts, five replications of each treatment were applied on July 24, 1990 between 11:00 am and 4:00 pm. Temperature at application was 75°F and conditions were still. All products were applied with a single nozzle, hand-held CO_2 sprayer from R&D Sprayers. The application was made at 50 psi through an 8003 nozzle. Insecticides were mixed with water and applied at a rate of 242.2 ml/16ft^2 (4 gal/1000ft^2). Postcounts were made eight days later on 1 Aug. For the precounts and postcounts, each plot was divided in two and each 2' x 4' half was counted for two minutes. The two counts from each replication were then totaled. The test was conducted at a home lawn with a mixture of Kentucky bluegrass and fine fescue, a 0-1/8" thatch layer, and sandy soil. The area was damp from rain at the time of application; it had rained several times the previous week. Many chinch bugs infected with Beauvaria bassiana were sporulating during the postcounts.
Chinch bug populations rapidly declined in all plots during the 8 days between treatment and evaluation, presumably due to an epizootic of Beauveria bassiana. In the final counts all insecticide treatments had less chinch bugs per plot than the control (DMRT, P = 0.05). However, the analysis of variance for all treatments was not significant (P = 0.215, Table 4).

JAPANESE BEETLE TEST: A grid of 3' x 3' plots separated by 2' wide buffer strips was established in irrigated rough adjacent to a fairway at Rochester Golf Club in Rochester. Six replications of each treatment were applied on 31 Aug. Temperature at application was 81°F with sunny weather conditions. Liquid products were applied with an R&D sprayer at 50 psi with an 8003 nozzle. Insecticides were mixed in water and applied at a rate of 4 gal/1000 ft^2. Granular insecticides were applied with custom-made hand-held shakers. The experiment was evaluated on 28 Sep by digging a 294 inch^2 (six 7" x 7" squares) section from the center of each plot and examining thatch, roots, and soil for live grubs. This test was on Kentucky bluegrass with 1/4"-thick thatch layer and sandy loam soil. Irrigation was run for 30 min prior to application. The pH of the irrigation water was 7.2. All liquid and nematode treatments were irrigated with 1/4" water applied through a watering can immediately after application.

Fonophos MS, Sevimol 4 SC, Triumph, and Crusade 5G, were the most effective treatments (0.7, 2.2, 2.8, 4.2, and 4.3 grubs per 294 inch^2, respectively) when compared with the control (14.2 grubs per 294 inch^2). The other treatments did not provide adequate control of Japanese beetle larvae (Table 5).

EUROPEAN CHAFER LARVAE CONTROL, BELMONT, MI, 1990: Curative treatments: A grid of 3' x 3' plots separated by 2' wide buffer strips was established at Blythefield Country Club in Belmont, Michigan. Six replications of 11 treatments were applied on 20 August, 1990 between 9:00 and 11:00 AM. Temperature at application was approximately 70°F with a slight rainfall (0.21") about 9:30 AM followed by sunny weather conditions. The plots were established on an irrigated rough with sandy soil. Irrigation was applied approximately every other day depending on rainfall. Insect parasitic nematodes were applied while the grass was wet with dew and then hand irrigated with 1/4" of water applied through a watering can immediately after application. Liquid products were applied with a single nozzle hand-held wand CO_2 sprayer from R&D Sprayers. The application was made at 50 psi through an 8003 nozzle. Insecticides were mixed with water and applied at a rate of 137 ml/9 ft^2 (175 gal/A). Granular insecticides were applied with modified "salt" shakers. Evaluations were made on 17 September, 1990 by removing 294 sq. inch (six 7" x 7" squares) sections of turf, roots, and soil per plot and counting larvae. Preventive treatments: A grid of 4' x 4' plots separated by 1' wide buffer strips was established in irrigated rough at Blythefield Country Club. Six replications of 4 insecticide treatments were applied on June 11, 1990. Granular insecticides were applied the same as described above. Evaluations were made on 17 September, 1990 using the same method described above. The preventive and curative plots were on different fairways.

NTN 33893 and MAT 7484 applied in June were effective in reducing European chafer grubs found in September. However, MAT 7484 was not as effective when applied on 20 August and evaluated on 17 September. None of the curative treatments applied on 20 August significantly reduced grub populations. Of the curative treatments, B-980 nematodes and MAT 7484 provided the best grub population reduction (54% and 58% reduction, respectively, Table 6).

Table 3. FAIRWAY ANT TEST - 1990
Ionia Country Club

Treatment	Rate (lb AI/acre)	Mean number of ant mounds per 144 ft^2 plot* 15 Aug	23 Aug	30 Aug	6 Sep	13 Sep	26 Sep
019537	2.5 lb/1000 ft^2	20.7 a	18.0 ab	6.8 bc	8.0 bc	8.5 ab	7.5 ab
Pageant DF	1.0	24.3 a	21.3 a	10.0 ab	19.7 a	18.0 a	13.2 a
XRM-5184	1.0	24.3 a	10.2 bc	4.7 bc	4.2 bc	8.5 ab	7.0 ab
Dursban ME 20	1.0	26.7 a	11.8 b	7.7 bc	6.8 bc	8.8 ab	6.2 ab
Triumph 4E	1.5 oz/1000 ft^2	24.2 a	4.7 c	3.3 c	1.7 c	2.7 b	3.7 b
Control	----	21.8 a	27.3 a	15.2 a	14.5 ab	19.5 a	8.7 ab

*Means within a column followed by the same letter are not significantly different (P= 0.05; DMRT)

Table 4. HAIRY CHINCH BUG TEST - 1990

Treatment	Rate (lb AI/acre)	Chinch bugs per plot 24 Jul	1 Aug
Sevimol 4SC	6.0	65.0	3.0
Sevimol 4SC	8.0	63.0	0.8
Mocap 5G	5.0	78.6	6.8
Pageant DF	1.0	45.0	3.8
XRM-5184	1.0	35.6	0.8
Dursban 4E	1.0	83.8	1.4
Tempo 2	0.14	38.4	1.2
Triumph 4E	1.0	39.0	3.4
Control	--	62.6	25.8

Table 5. JAPANESE BEETLE TEST
Rochester Golf Club

Treatment	Rate (lb AI/acre)	Larvae per plot 28 Sep*
Sevimol 4SC	8.0	2.2 b
Mocap 5G	5.0	5.2 ab
Crusade 5G	4.0	4.2 b
019299	4.0	4.3 ab
019312	4.0	5.7 ab
Fonophos MS	4.0	0.7 b
ICI 08882	1.0	10.3 a
ICI 08882	2.0	6.3 ab
Triumph	0.5	2.8 b
Nematodes	1.0 billion/acre	10.8 a
Control		14.2 a

*Means followed by the same letter are not significantly different (P = 0.05; DMRT).

Table 6. EUROPEAN CHAFER TEST, 1990
Blythefield Country Club

Treatment	Rate	Description	Larvae per plot
NTN 33893 .5G	0.38 lb AI/acre	preventive (June 11)	0 c*
NTN 33893 .5G	0.5 lb AI/acre	preventive	0 c
MAT 7484 .8G	0.75 lb AI/acre	preventive	5.2 b
MAT 7484 .8G	1.0 lb AI/acre	preventive	2.8 bc
Control 1	--		11.5 a
MAT 7484 .8G	0.25 lb AI/acre	curative (Aug. 20)	10.0
MAT 7484 .8G	0.5 lb AI/acre	curative	8.0
Crusade 5G	4 lb AI/acre	curative	14.2
Fonophos MS	4 lb AI/acre	curative	12.5
ICI 08882	1 lb AI/acre	curative	18.8
ICI 08882	2 lb AI/acre	curative	13.7
B-27 N nematodes	1 Billion/acre	curative	10.7
B-980 nematodes	1 Billion/acre	curative	7.5
Triumph 4E	0.5 lb AI/acre	curative	15.3
Control 2	--		13.8

*Means followed by the same letter are not significantly different (P= .05, DMRT).

Figures 1 A, B. The relationship of grubs per square foot of turf to visual ratings (A) and actual turf injury as measured by pounds of pull necessary to lift rooting boxes (B).

Figure 1A.

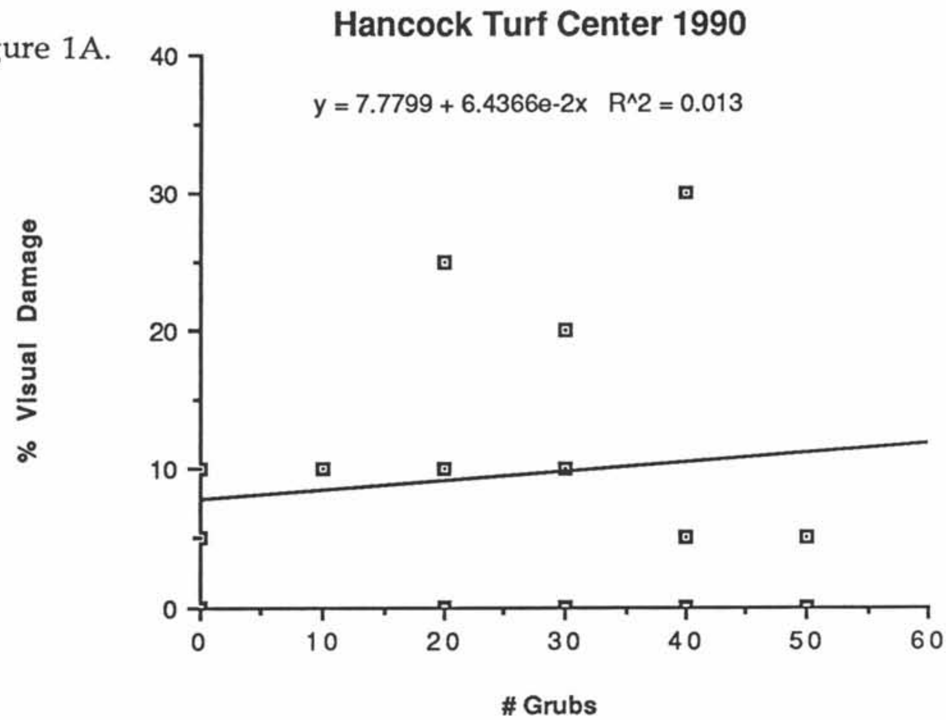

Figure 1B.