# Cultural, Biological and Insecticidal Management Strategies for Japanese Beetle and European Chafer

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## Introduction

Japanese beetle and european chafer grubs cause visible damage to many home lawns and golf courses in Michigan each year. Japanese beetles are a turf problem in many areas of Michigan south of a line between Saginaw and Grand Rapids. In particular, portions of Detroit area, Kalamazoo, Monroe, Battle Creek, Ann Arbor and Jackson are heavily infested. European chafer is not as widespread in Michigan. However, serious turf injury from european chafer grubs has been reported in Grand Rapids and Detroit area. Because these two insects have similar lifecycles and habits they can be discussed together when exploring management options.

## Damage Thresholds

Exact thresholds cannot be determined for grub damage due to variability in turf management practices and philosophical differences in determining what is an acceptable level of injury. However, some guidelines should help turf managers decide when injury from grubs is likely. In general, adequately irrigated and fertilized turf withstands and compensates for grub injury better than poorly maintained turf. At drought-stressed locations, seven grubs per square foot of turf may cause considerable injury while highly maintained turf may withstand 20 grubs per square foot without showing any visible signs of injury. It is not usually necessary to apply an insecticide for grub control when there are less than seven grubs per square foot in low maintenance lawns or 20 grubs per square foot in high maintenance lawns. Because grub populations tend to be clumped and distributed irregularly in lawns, I suggest sampling for grubs by digging at least four 1/4-ft.$^2$ sections with a flat shovel that has a 6"-wide blade.

## Cultural Management

At this time there are no practical cultural practices that will reduce grub populations. The most practical cultural practices are instead aimed at growing healthy grass plants capable of withstanding some grub feeding injury. Proper fertilization and watering are extremely important. Properly maintained plants can survive considerable root pruning injury. Watering is usually more critical to survival than is fertilization. When turfgrass is adequately watered it can withstand three times as much feeding injury from grubs when compared to drought-stressed turfgrass. Grass plants that have all of their root system pruned off from grub feeding are very susceptible to drought-stress and will die quickly unless soil moisture is maintained at adequate levels.

Grass types resistant to grubs have not yet been identified. Apparently, all grasses used in home lawns and golf courses are susceptible to grubs.

## Biological Control

One biological control product usually known as 'milky spore disease' has been available for many years. The spore powder is made by collecting grubs from turfgrass and injecting them with the live bacteria that causes the milky spore disease. The bacterial pathogen is *Bacillus popillae.* It is a spore forming bacterium often found to naturally infect populations of Japanese beetle grubs. Because Japanese beetle is an imported insect, there is some advantage to spraying the milky spore products in areas where the pathogen may not be naturally found. Unfortunately, the milky spore disease products are very expensive and not practical for most turf management companies. The benefit of using milky spore powder comes from the fact that the product is non-toxic to people, pets and non-target organisms, and it may spread naturally to provide some control of grubs in future years. The major disadvantages are the high cost and slow activity. In some cases it may take two years for the milky spore disease to spread adequately through the grub population. Another disadvantage of using milky spore powder is that the bacterium tends to be a species specific pathogen. The bacterial spores collected from Japanese beetle larvae tend to be most effective against Japanese beetle, and less effective against european chafer and other grubs. Milky spore disease is produced by Reuter Laboratories (Gainesville, Virginia), and Fairfax laboratories (Clinton Corners, New York). The Reuter product "Grub Attack" has had some quality control problems in past years, but seems to be fairly effective the last couple years. "Grub Attack" is widely distributed, and can be purchased at Meijer stores in Michigan. The Fairfax products "Doom" and "Japademic" can only be purchased by writing or calling Fairfax Biological Laboratory (Electronic Road, Clinton Corners, NY 12514, (919) 467-8352). "Doom" and "Japademic" have always been good products. One thing to keep in mind when using milky spore products is the poor shelf life. At a relative humidity of 40% or greater the spores lose activity within four weeks. The powder must be stored under very dry conditions (<15% relative humidity).

Another biological control product is being developed for use on turfgrass by Biosis, Inc. in Palo Alto, California. Biosis is mass producing a nematode that attacks and kills many soil insects including Japanese beetle and european chafer grubs. The nematode, *Steinernema feltiae,* only reproduces inside insects. It is not capable of feeding on plant roots and does not cause any injury to grass roots. The nematodes are grown inside waxmoth larvae and dried into a powder-like material that can be dissolved in water. A commercial product for use on turfgrass should be available in 1989. In research trials, the nematodes have been as effective against grubs as some insecticides. The nematode product has the added advantage of being completely safe to people, pets, beneficial insects and plants. The estimated cost for this product is $40.00 per acre.

## Insecticide Management

In most cases where grubs are causing serious injury to turfgrass, insecticides are a practical management tool. Insecticides are not recommended for lawns free of insect problems because the insecticide will kill many beneficial insects. Eliminating grubs with an insecticide will reduce the amount of root pruning injury and will deter skunks, raccoons and moles by removing their food source. However, eliminating grubs will not always result in moles leaving infested lawns.

The major factors influencing success or failure of an insecticide used for grub control are product selection, timing of application, irrigation following insecticide application and thatch thickness. Product selection is usually based on effectiveness, cost, and safety (Table 1). The products listed in Table 1 are fairly toxic pesticides when compared to most herbicides and fungicides. Maximum safety measures should be taken to prevent contact with any of these products. All of the grub insecticides are class II pesticides, that have **WARNING** as the signal word listed on the label. The only exception is the product "Sevin" that is somewhat less toxic and has "Caution" as the signal word. Therefore, Sevin is the least toxic and safest of the pesticides listed in Table 1. Unfortunately Sevin is also slightly less effective against grubs compared to the other products.

All of the insecticides tested are very effective against grubs. The range of control expected from these products was determined by compiling research reports from university efficacy trials during the last five years. Although some products tend to provide slightly better control than other products, these differences are variable depending on test conditions. Successful control depends more on where, how, and when the insecticide is applied than the specific product being used.

Turfgrass insecticides come as granulars, powders or emulsifiable concentrates (liquids). Iinsecticides mixed in water and sprayed onto turfgrass as a liquid must be watered in with a 1/2" of irrigation immediately after application. Otherwise the insecticide will quickly break down before it is soaked into the soil where the grubs are. Even waiting a few hours on a hot sunny day before starting the irrigation may reduce the percent control obtained. In contrast, granular insecticides do not have to be watered in immediately. Even waiting several days for rainfall does not seem to hurt granular insecticide activity very much.

Timing is an important factor. In Michigan insecticides for grub control are most effective when applied from late April to early May or from middle August to early September. One advantage to applying insecticides in August is that the grubs are killed before they cause plant injury. If the grubs are eliminated in August there will be no plant injury in September or the following spring. However, when insecticides are applied in April, you may still see some turfgrass injury due to grub feeding in August and September because the adult beetles are very mobile, and may move from other areas to lay their eggs in July on lawns that were treated with insecticide in April. None of the insecticides in Table 1 will provide good control in August when they are applied in April. The one possible exception is Oftanol. Oftanol usually biodegrades slowly enough that some active insecticide is still present

in August when it was applied in April. The April to August carry over is usually good enough to provide 50 - 75% control. However, this carry-over effect may weaken with each consecutive year Oftanol is used, due to increased microbial activity.

**Table 1.** Insecticides recommended for control of Japanese beetle and european chafer larvae on turfgrass.

| Insecticide | Formulation | Amount of Formulation per 1,000 sq. ft. | Expected % Control |
|---|---|---|---|
| Triumph*[1] | 4E | 1.5 oz. | 65 - 95 |
| Oftanol | 5G | 0.9 lbs. | 65 - 95 |
| Oftanol | 2I | 3 oz. | 70 - 95 |
| Oftanol | 1.5G | 3.0 lbs. | 65 - 95 |
| Proxol*[2] | 80SP | 3.7 oz. | 65 - 95 |
| Dylox | 80SP | 3.7 oz. | 65 - 95 |
| Mocap | 10G | 2.3 lbs. | 60 - 95 |
| Turcam | 76WP | 0.75 oz. | 65 - 95 |
| Diazinon | Ag 500 | 4.6 oz. | 60 - 90 |
| Diazinon | 2E | 8 oz. | 50 - 90 |
| Diazinon | 5G | 3 lbs. | 50 - 90 |
| Sevin | SL | 6 oz. | 70 - 80 |
| Sevin | 80S | 4 oz. | 65 - 80 |

*[1]For use on home lawns only.
*[2]Proxol and Dylox should not be mixed with water that has a ph of 8.0 or above.