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Turf Grass TRENDS

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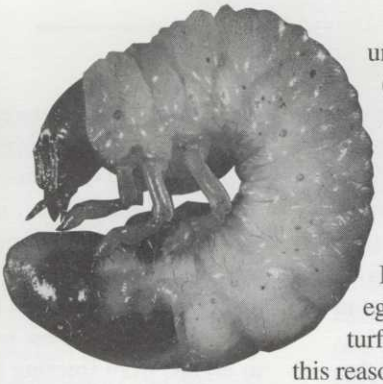
Effective management of Japanese beetles



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JAPANESE BEETLES are among the most damaging turfgrass pests east of the Mississippi River. Unlike many turfgrass insects that feed at only one life stage or on only one plant part, Japanese beetles feed on the leaves and fruits of many weeds, ornamentals and tree varieties as adults—and on turfgrass and other plant roots as grubs. Because of this, turfgrass managers may consider Japanese beetles as two separate pests, each requiring a different strategy for effective control.

Deciding when, where and how to treat adult Japanese beetles is relatively straightforward, but that is not the case for beetle grubs in the soil. The management of Japanese beetle grubs will never be easy. Knowing where, when, how and if to treat for grubs is difficult to determine. Short residual insecticides require a better understanding of when and where to treat for grubs, and public demands that insecticide use be decreased or eliminated dictate that turfgrass managers become increasingly knowledgeable of the ecology of this pest.

Understanding how Japanese beetles live

MOST JAPANESE BEETLES have a one year life cycle—that is, one cycle of adults, eggs and grubs in the soil each year. Adult beetles begin to emerge from the soil in early to mid-summer, with peak populations in the Northeast occurring during the first week in July. Years with unseasonably cool temperatures (such as 1992) may cause an emergence delay of two weeks or longer.

Female beetles have as many as 20 mature eggs to lay soon after they emerge and mate. In many cases, a high number of eggs are laid by females close to the turf from which they emerged. For this reason, some turf areas seem to have high populations of grubs year after year. After laying her first batch of eggs, a female beetle must feed to mature more eggs. Males beetles are attracted to females by a sex lure compound (pheromone) that is given off by females. Both male and female beetles fly to feeding sites soon after initial mating and egg-laying. Feeding adult beetles are closely associated with such weed species as smartweed, wild blackberry, wild grapes, crabgrass, ragweed and cattails, and common ornamentals such as crab apple, wild cherry, peaches, plums, maples, birch, roses, sassafras, mountain ash and linden.

Female Japanese beetles do not simply lay their eggs on the soil surface. They crawl down into the soil 2 to 6 inches to deposit their eggs. Eggs and young grubs are extremely sensitive to temperature and moisture extremes and the soil environment is more moderate and stable at those depths. Under extreme environmental conditions of dryness and high soil temperatures, the eggs may not hatch and young grubs may not survive. The ideal soil for egg laying is well-drained, non-compacted and loamy. This type of soil generally will not flood in rainy periods or dry completely during drought. As a good rule of thumb, soil conditions that are ideal for growing turf are also ideal for growing Japanese beetles.

Locating and controlling grubs

MOST PROPERTIES HAVE AREAS that have the *potential* for grub problems every year, some areas that *will* have grub problems most years and other areas that seldom, if ever, see grubs. This is mainly

– continued on page 2

IN THIS ISSUE

due to the proximity of turfgrass to feeding sites, soil characteristics of the various egg-laying (oviposition) sites, and the wetness or dryness of the year. For example, well-drained hilltops may have heavy grub populations in relatively wet years while poorly drained low areas will have the best conditions for egg hatch and grub survival in very dry years.

After hatching, the grub or immature feeds on turfgrass roots at the soil/thatch interface. Grubs are often able to escape poor soil conditions by moving down further into the soil. If the soil is hot and dry, grubs may move down several inches to the cooler and more moist depths of the soil. If however, light irrigation is used on a regular basis, the coolest and wettest part of the soil may be the upper root zone, and that is where you should expect to find the grubs.

By early-August grubs are often sufficiently large that feeding damage may be apparent in areas with high infestation levels. Ideally, it is the best time to look for beetle grubs in the soil. At this stage the grubs are still small but easily seen and identified. Early detection of heavy grub populations at this time will give adequate time for you to treat them. The use of a cup cutter to determine grub populations in an area often reduces the need for blanket insecticide treatments for grub control. Areas that show one or more grubs per 4 inch cup cutter plug (about 10 grubs per square foot) warrants treatment. In general, treating grubs when they are small and feeding at the thatch soil interface produces the best control. Remember,

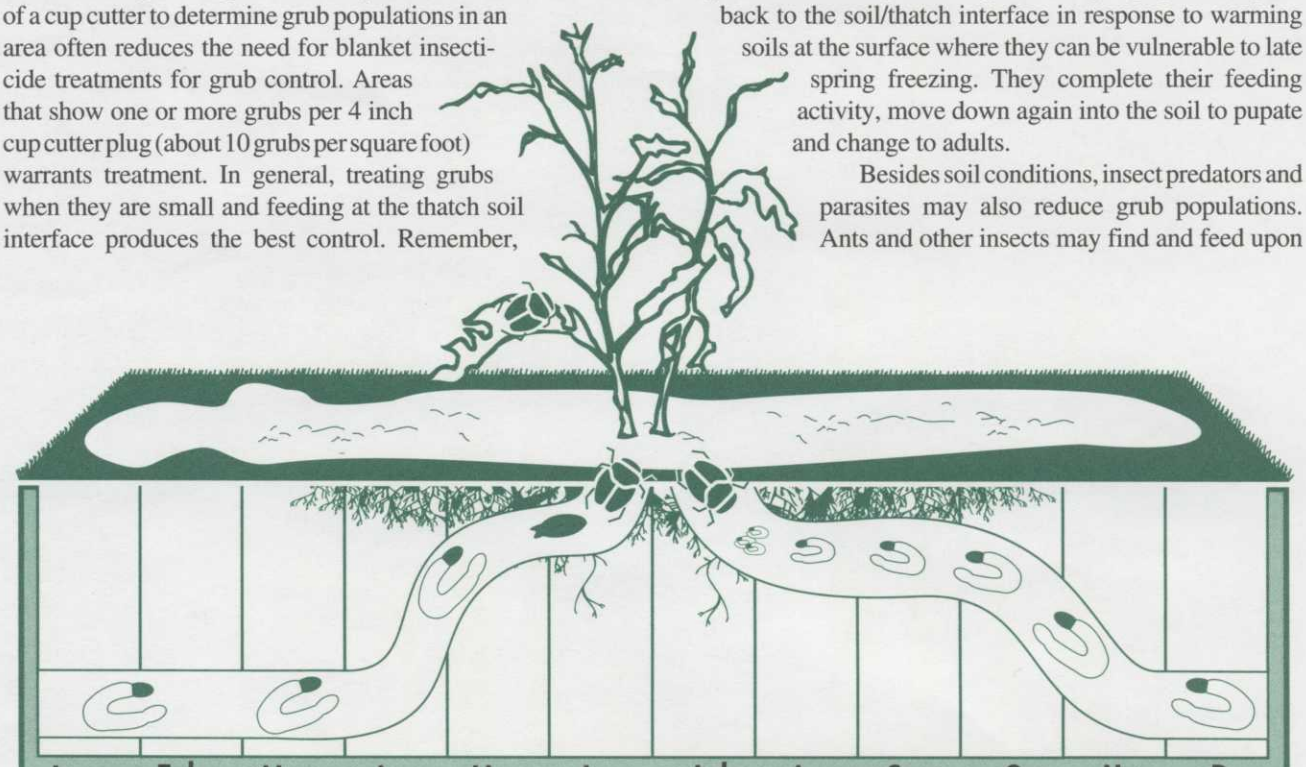
. . . turfgrass that is successfully treated in late summer for Japanese beetle grubs will not have to be retreated the following spring. There can never be more Japanese beetles in an area in April and May than there were the previous fall.

because there is only one generation of Japanese beetles each year, turfgrass that is successfully treated in late summer for Japanese beetle grubs will not have to be retreated the following spring. There can never be more Japanese beetles in an area in April and May than there were the previous fall.

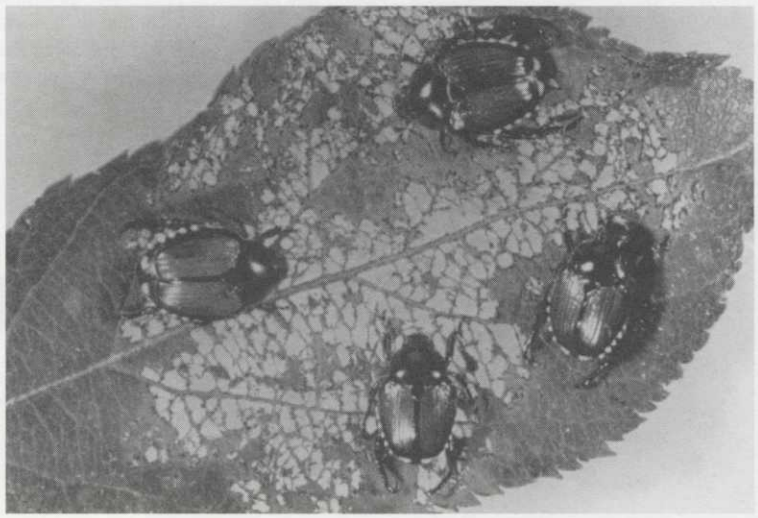
It is important to remember that grubs will be moving down into the soil profile to escape from falling temperatures in autumn. Several nights with temperatures below freezing are enough to drive grubs down below the level where insecticides can be effective. Because most insecticides take from several days to several weeks to show maximal effectiveness, turfgrass managers should take care in choosing control materials for late fall applications and take care not to treat too late in the fall.

Although Japanese beetle grubs move down into the soil to escape from freezing temperatures, additional mortality often occurs over the winter. This can occur if the grubs are prevented from moving far enough into the soil to escape lethal environmental conditions. Sudden cold spells when there is little snow cover to act as an insulator often causes high over wintering mortality. In the spring, grubs migrate back to the soil/thatch interface in response to warming soils at the surface where they can be vulnerable to late spring freezing. They complete their feeding activity, move down again into the soil to pupate and change to adults.

Besides soil conditions, insect predators and parasites may also reduce grub populations. Ants and other insects may find and feed upon



One Year Life Cycle of the Japanese Beetle



Japanese beetles feeding. Chewing the tissue between the veins in foliage, Japanese beetles can cause severe damage in a relatively short period of time. Pheromone (sex hormone) traps can attract large numbers of adults, but vegetation near the traps may suffer. In addition to attacking ornamental trees and shrubs, adult Japanese beetles also feed on corn silk and can damage a number of crop plants.

grub eggs, while parasitic wasps and ground beetles(carabids) may attack and kill grubs in the soil. Japanese beetle grubs will also attack each other if they are too closely packed in the soil. Although the reason for this predatory activity is not well understood, it may have evolved to allow each grub to have sufficient turf roots to feed on as it grows and develops. One good reason not to use soil insecticides indiscriminately is to preserve the natural predators and parasites found in every soil. Larger vertebrate predators—such as skunks, raccoons and birds—also help to reduce grub populations.

As in human populations, fungal, bacterial and viral diseases (including milky disease) may cause high grub mortality in areas where high grub populations are found. Milky disease of scarab grubs is caused by a bacteria. Every grub species has its own particular bacteria that will cause milky disease in that species. The commercial brand of milky disease is most effective against Japanese beetles and will not infect other grub species very readily.

In soils with high Japanese beetle populations and consistently warm soil temperatures, milky disease builds up in the soil and may reduce grub population below economic damage thresholds after several years. Commercial milky disease in not effective in cooler climates, and where Japanese beetles are not the most common grub species found.

Natural populations of parasitic nematodes may also reduce grub survival. There has been great interest in the possibility of using these nematodes control Japanese beetle grubs in turfgrass. Insect parasitic nematodes may offer a biologic control alternative to conventional insecticides when applied in an inundative release program. Nematodes may be applied through conventional spray equipment, and irrigation requirements are similar to those needed for effective control with chemical insecticides.

Two species of nematodes have shown promise for controlling Japanese beetle grubs in turfgrass, *Steinernema glaseri* and *Heterorhadditis bacteriophora. S. glaseri* was originally described from infected Japanese beetle grubs collected in New Jersey and has the advantage of superior production and storage properties when compared with *H. bacteriophora.* An advantage of *H. bacteriophora* is that their infective stage has a tooth that allows them to enter through the grub's body wall, while *S. glaseri* must enter through an existing body cavity—usually the grub's mouth. *H. bacteriophora* also appears to be superior grub hunters in the soil, allowing them to find and infect grubs more efficiently. Other commercially available nematodes have been shown to be less effective at controlling scarab grubs in turf.

Fungal pathogens also may reduce the number of scarab grubs in turfgrass. In general, warm, moist conditions improve the chance that a fungal disease will reduce grub populations. Indiscriminate use of fungicides to control plant pathogens is not recommended, in part, because such use also reduces populations of beneficial, insect pathogens.

Controlling adult beetles

CONTROLLING ADULT JAPANESE BEETLES may be important for saving valued ornamental plants from feeding damage, but there is no evidence that reducing adult populations will lessen grub damage to turfgrass. Also, the use of Japanese beetle traps will not protect valuable plants or reduce grub damage. These traps, which combine a pheromone to attract adult males and food lure to attract both male and female beetles will draw beetles from long distances. Some will end up in the trap, but many more will end up on surrounding trees and shrubs. The most effective use of a trap to protect your ornamentals is to convince your neighbor to put one in his yard!

The general strategy for controlling adults with insecticides is to treat the foliage in early morning when beetles are actively feeding on the leaves. The beetles will feed on insecticide-covered leaves and also come into direct contact with the insecticide as they rest on the leaves. Because most insecticides work as both a contact and stomach poison, treatment at this time offers the best window of control.

Additives that enhance the adhesion of the insecticide to the leaves and reduce the degrading effect of sunlight (UV) on the insecticide may increase the residual effects of the insecticides on the leaves. Although adults are relatively easy to kill, ornamentals are often repopulated with adults within several days after treatment. For this reason, multiple treatments of insecticide may be needed to protect valued plants. ■