Managing White Grub Infestations

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Editor's Note: We went back to the East Coast, back to Ithaca, New York and Cornell University for some advice from across the country. This article, relevant as we prepare for the new golf season, appeared in Vol. 9, No. 2 issue of CUTT and is reproduced with permission from editor Dr. Frank S. Rossi. The article spends time addressing the value of mapping insect problems, a subject Dr. Villani lectured about at a Wisconsin Golf Turf Symposium a number of years ago. The principles are reinforced in this article.

White grubs found in turfgrass are the immature forms of several kinds of scarab beetles. In high populations they can cause serious damage to lawns and golf courses. Late summer scouting for grubs in the soil below turf is the best way to determine where treatment is necessary. Treatment can be done while the grubs are small and susceptible to management, before heavy feeding begins in late September. Japanese beetle and European chafer grubs are the most important turf insect pests in New York State. Both species have life cycles that are similar in terms of basic biology and time windows of sensitivity to biological chemical controls.

Japanese beetle grubs overwinter as a third instar larva in the soil below the frost line. In spring, they move up in the soil to feed on roots, then pupate for one to three weeks within the cast skin of the grub. As the insect matures the cover splits and the adult beetle is ready to emerge. Japanese beetle adults crawl out of the ground in late June and early July. They can fly as much as a half a mile a day. The adults feed on the foliage of over 300 different species of plants. The beetles mate, and females are ready to lay eggs about one week after emergence. The female beetles lay 40 to 60 eggs in the soil over a two to three week period. Eggs hatch within two weeks into first instar and feed on roots for three to four weeks. These grubs molt and become second instars that feed for three to four weeks. The grubs molt again to become third instars by the middle of September. They continue to feed until they reach full size before winter. As temperatures drop in the autumn, the grubs migrate down in the soil.

European chafer grubs have an annual life cycle similar to Japanese beetles except that they feed later into the fall and start feeding again during warm spells in the winter. European chafer adults usually emerge slightly earlier in the spring than Japanese beetles. European chafer adults emerge at dusk and are attracted to light and vertical objects in the landscape, often forming large swarms around small trees. Adult European chafers do not feed, staying above ground just long enough to mate. Mating pairs of European chafers fall from the trees and crawl back into the turf where females lay several dozen eggs over several days.

Mapping Grub Locations

Intensive sampling of ten golf course fairways and roughs on two golf courses in Central New York from 1995 to 1997 allowed us to map the location of Japanese beetle and European chafer grubs. These maps suggest that there are extreme fluctuations in grub populations from year to year, and that years that are favorable for one grub species may not be favorable for a second species. There are clear differences in where we find the various grub species on this fairway: European chafer grubs are found predominately in the rough areas and Japanese beetles tend to prefer well managed irrigated turfgrass that is close to vegetation suitable for adult feeding. They appear to prefer loamy soils in full sun. By comparison, European chafers are found in lower maintenance turf sites, without irrigation, and with sandy, well-drained soil textures. They are also commonly found surrounding small trees that serve as aggregation sites for mating pairs.

Our studies indicated that some areas have the potential for grub problems every year, some areas will have grub problems most years and there are other areas that seldom, if ever, see grubs. This is mainly due to the proximity of turfgrass to feeding sites, soil characteristics of the various 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. By early August grubs are often sufficiently large that feeding damage may be apparent in high density areas. 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.

Sampling Techniques

The techniques required to sample the soil underlying turfgrass areas are the most arduous and the most disruptive to the turf. The population of soil insects such as white grubs usually is distributed unevenly, so soil samples often must be as large as one sq. ft. Because some turf damaging grubs remain strictly in the soil, disruption of the soil is necessary to obtain accurate counts. When samples are taken with a spade, the depth of sampling is often variable because of the rooting habits, soil moisture, and soil texture. Most often sampling is much deeper than necessary in order to ensure that all grubs are found. One method of examining samples of sod and soil is to cut three sides of a square to a depth of five inches and turn back the cut area to expose the soil This procedure allows many of the plants to keep their root system intact. Samples which involve one sq. ft. sometimes heal very slowly, leaving dead or dying patches of turf. Smaller samples often provide nearly as accurate an assessment of the grub population but recover much more quickly.

The quickest and least destructive method of collecting a soil sample is to use a cup cutter, four inches in diameter, to collect samples to a depth of five inches. Samples can be taken and inspected very quickly, enabling a scout to check several different locations and to provide more accurate information about spatial distribution of white grubs. The use of a cup cutter to determine grub populations in an area often reduces the need for blanket insecticide treatments for grub control. In general, treating grubs when they are small and feeding at the thatch soil interface produces the best control.

Analyzing the Sample

Grub sampling determines where the highest grub populations are found, which grub species is the most common, and what is the predominant development stage of the grubs found. Systematic sampling also indicates if a large number of the grubs are infected with bacterial or fungal pathogens, turf root health, thatch density, and soil texture, compaction and moisture. Long term benefits of systematic sampling are the identification of susceptible or favorable turf areas, the development of personal thresholds, and when undertaken before and after the application of an insecticide, treatment efficacy.

Fewer than five grubs per sq. ft. indicates a low population, lower than the standard damage threshold of seven to ten grubs, and no need to treat, whatever the kind of white grub. However, the specific situation should be taken into account in the decision whether to spray. Personal values should be incorporated in setting up the threshold level. The tolerance level, or action threshold, for turfgrass insects is site-specific and depends on many factors, such as pest species or complex, turfgrass species and cultivar, turf use, turf vigor, time of years, expectations, availability of curative control options, and budget. Turf managers often are less concerned with insect infestations that are found in autumn on cool season grasses, because most insects are noticeably less active at cooler temperatures and the turf is more able to recover from any damage that occurs.

Jennifer Grant, working with the New York State IPM Program, sampled and mapped thirty-six golf courses in Central New York each fall over a four year period for Japanese beetle and European chafer grubs. Each fairway was sampled using a standard cup cutter; four cores were taken across the fairway at 30 yard intervals, with sampling skewed toward roughs on wide fairways. The sampling team consisted of three to eleven people all trained to recognize grubs and larval stages and one or more persons capable of species identification. By carefully monitoring the time it took to map the golf course, Jennifer determined that it took an average of two labor hours to sample and map a typical hole, or 36 hours to map a typical 18 hole golf course (this means that it take one worker 36 hours, six workers 6 hours, and ten workers 3.5 hours). Using these estimates the cost of mapping a typical course would be $180 if your workers were paid $5.00 an hour, $252 if they were paid $7.00 an hour, or $360 if they earned $10.00 an hour. The estimated cost of grub insecticides would have been considerably higher; the cost for treating 25 acres of turf could range from $1,825 to $3,684, while treating 60 acres could cost between $4,380 to $8,842 using standard grub insecticides. Over the four years of this study 17 golf courses required no grub insecticide treatments, 16 golf courses required spot treatments, and only three courses required treatments on all fairways.