Integrated Pest Management of Insects

by Jennifer A. Grant

At this time of year, turf managers are often forced to think about insects. Scarab grubs have begun their annual feeding cycle in many parts of the country, and the optimal period for mole cricket control is ending in the South. If you are lucky enough to have escaped those pests, perhaps you are battling cutworms, billbugs, or chinch bugs this season. Regardless of your individual insect woes, IPM techniques can help you detect, identify, and manage such pests.

Monitoring is essential

Successful management of most turf insects depends on the detection of pests before they reach damaging levels. This can best be accomplished through frequent turf inspections in search of early signs of insects and their damage.

Monitoring or "scouting" is a systematic method of inspecting turf for pests and cultural problems. It should be the backbone of any pest management program. Its primary goal is to detect, identify, delineate, and rank pest infestations and turfgrass abnormalities. All turf areas should be monitored on a regular basis during the growing season. The scouting interval may vary from one to two days to several months, depending on the location and use of the turf.

Among the more common symptoms of insect-damaged turf are a general thinning of the grass, spongy areas, irregular brown patches, and plants that break away easily at soil level. Substantiating the insect origin of the problem may be difficult, however. Many of the symptoms just described could also have been caused by heat or drought stress, nutritional deficiencies, turf diseases, soil compaction, chemical burns from gasoline, fertilizers, herbicides or insecticides, scalping during mowing operations, or even animal excrement spots. If the problem is insect-related, a close visual inspection of the damaged area should reveal either the insects themselves or indirect evidence of their presence.

Similarly, bird and animal feeding activity often indicates potential insect problems. Starlings, robins, moles, skunks, and raccoons are well-known insectivores. Once again, confirmation of the insect origin of a problem requires close examination of the injured area. Look for signs of skeletonized leaves, clipped grass blades, fecal pellets (excrement), sawdust-like debris, stem tunneling, silken tubes or webbing. Reference books can then be used to identify the insects causing the damage.* If no evidence of insects or their feeding is found, the condition is probably due to another cause.

Insect sampling

In addition to the visual monitoring of turf, insect sampling techniques are useful IPM tools, offering further evidence of the presence and severity of insect problems. Insects are often difficult to find because of their size and covert feeding habits. Some sampling methods can simplify the search process, often by encouraging or forcing insects out of their hiding places. It is not necessary to collect samples on every scouting visit, only when the presence of insects is suspected.

When sampling is indicated, target those areas most likely to be infested first. Divide large plantings into smaller, more-or-less homogeneous areas

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***Recommended References:**

Brandenburg, R.L.and M.G. Villani (eds.), Handbook of Turfgrass Insect Pests, Lanham, MD: Entomological Society of America, 1995 [available September, 1995; $30; telephone (301) 731-4535 to order]

Shetlar, D.J., P.R. Heller and P.D. Irish, Turfgrass Insect and Mite Manual, Bellefonte, PA: Pennsylvania Turfgrass Council, 1983; [revised edition available November, 1995; telephone (814) 863-3475 ot write Pennsylvania Turfgrass Council, Landscape Management and Research Center, Orchard Road, University Park, PA, 16802 for information].

Tashiro, H., Turfgrass Insects of the United States and Canada, Ithaca, NY: Comstock Pub. Associates, 1987.

— often referred to as pest management units (PMUs) — so they can be considered individually when making pest management decisions. For example, each tee, green, and fairway on a golf course might be considered a PMU. Likewise, the front and back lawns of residential properties can be considered separate PMUs (homeowners typically have differing aesthetic standards for these areas).

Tips on Sampling

■ *Sample if damage or other visual sign of insect activity is seen.* Example: Off-color turf accompanied by sawdust-like material around the crown of plants indicates billbug presence.

■ *Sample at the appropriate time in the insects' life cycle and the growing season.* Example: Check for scarab grubs in the early stages (1st or 2nd instar), before they cause significant damage.

■ *Sample in "indicator" areas that are highly susceptible or have historically been infested.* Example: A lawn that had chinch bugs last year is likely to have them again. Begin sampling in previously infested areas as soon as the weather turns hot. Once chinch bugs are detected, be alert for activity on properties nearby.

■ *Sample when a post-treatment analysis for efficacy of pesticides or other control measures is desired.* Example: High cutworm populations detected on several golf course greens result in an insecticide application. Sample the greens approximately five days later to be sure the treatment was successful.

Do not assume results will be the same throughout a turfgrass area, because insects are not distributed evenly. Once the need for control actions is assessed, move onto another PMU. Sampling and treatment decisions will depend on the availability of time and labor, and the aesthetic standards for each area. Descriptions of various sampling techniques follow. They are keyed to specific insect pests.

■ **Disclosing (irritant) solution:** Surface-active insects can be flushed from the turf with a disclosing solution. Mix 2–4 tablespoons of liquid dishwashing soap or 1 tablespoon of 1% pyrethrins into 2 gallons of water and pour the mixture over a square yard of turf. Insects irritated by the solution such as webworms, cutworms, armyworms, mole crickets, billbug adults, as well as earthworms, will come to the surface within five to ten minutes. After flushing, they are easily collected, identified, and counted. Treatment thresholds based on this sampling technique have been established for some insects. For example, 14 mole crickets per square yard are likely to cause damage. Because detergents vary in their concentrations and components, they should always be tested to determine the soap-to-water ratio that will irritate the target insects, yet not harm the turfgrass.

■ **Flotation:** Insert a large coffee can with both ends removed 1–2 in. into the soil. Fill the can with water and replace any water that escapes until the turf has been submerged for three to five minutes. Insects will float to the water surface where they can be collected, identified, and counted. Alternatively, remove soil cores with a golf course cup cutter and place them in a bucket of water for a similar period. Several cores can be soaking in the bucket simultaneously. Flotation is ideal for detecting chinch bugs and many of their natural enemies. Consider 20 chinch bugs in a cylinder with an 8–9 in. diameter a damage threshold.

■ **Soil examination (cup cutting and soil digging):** Some soil-inhabiting insects, such as scarab grubs, cannot be sampled by the methods previously discussed. These insects must be sought in the root and thatch zones where they feed. One sampling technique involves cutting three sides of a turf square (1/4 to 1 sq ft in area) with a shovel or knife, and peeling back the sod layer to expose white grubs, billbug larvae, and other soil dwellers. It is important to examine the entire root zone, including both the sod cap and the upper 1–3 in. of soil. Several samples should be taken to determine population levels throughout the area.

An easier method for sampling soil-inhabiting insects utilizes a standard golf course cup-cutter that removes 4-in. soil cores. In fact, these tools are so handy that lawn care professionals and other turf managers should purchase one. Cores can be rapidly inspected for insects as soil is discarded back into the original hole. If the sod cap is then replaced and the area irrigated, damage to the turf will be minimal. Record the number of each insect species found and its predominant life stage (instar) on a data sheet or map.

Inspecting soil samples in a grid pattern across any turf planting will help delineate areas infested by insects. Intervals of 20–30 yds. between samples in large turf areas should be sufficient. Ultimately, the number of samples taken will depend on the time and labor available. Studies in New York have shown that 20–40 samples can be examined per person per hour. Sampling time varies, depending on insect density, soil type, thatch thickness, and other factors.

Knowledge of grub/beetle life cycles will help you get the most out of your sampling effort. Sample when grubs are small: 1st and 2nd instar. For Japanese beetles in the Northeast, this is usually in early- to mid-August. Southern masked chafers in the middle and southeastern states should be sampled in late July or early August. Times vary by grub species and regional and local weather patterns.

Begin sampling a few areas several weeks before you expect grubs, in order to monitor the insects' life cycle. Once the eggs have finished hatching, and the majority of grubs are 1st or 2nd instar, initiate your full sampling plan. A window of 2–3 weeks is usually available to complete sampling.

Damage thresholds have been established for the major grub species.* Use these as guidelines for treatment decisions. Generally speaking, healthy turf with strong roots, adequate moisture, and low stress will tolerate grub infestations above the threshold level. Conversely, stressed turf will be susceptible to damage at threshold levels.

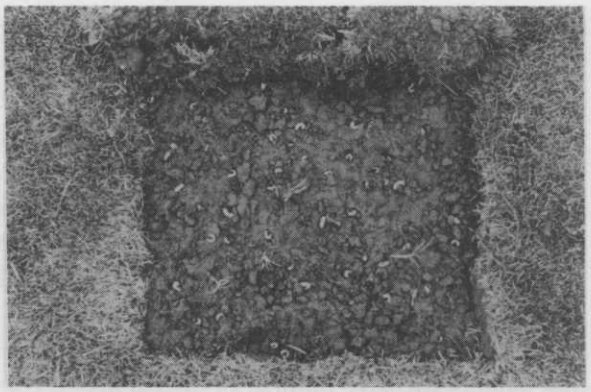
*See the article that follows for a discussion of these thresholds and their use.

■ **Traps:** Insect activity can be monitored using traps of various kinds. Most traps have an attractant (lights, pheromones, food scents) that lure insects. Upon reaching the trap, insects are captured by sticky surfaces or killed with insecticides. Typically, these traps are hung from trees or stakes in or near the turf area. Light traps collect a wide variety of flying insects, including scarab beetles, and cutworm, webworm and armyworm moths. However, it is difficult and time-consuming to sort and identify the large number of diverse insects collected. Pheromone traps, on the other hand, are highly selective and normally capture only one sex (usually males) of a single species of insect. Pitfall traps are placed in the ground so that the top is flush with the turf surface. These traps capture insects as they move along the ground. Arthropods such as mole crickets, billbug adults, ground beetles, and winter grain mites can be monitored using pitfall traps.

Insect traps provide important information confirming the presence and timing of activity of a particular pest in a particular area. For example, peaks in adult activity can be tracked and used to predict when damaging larval activity will occur later in the season.

It is important to fully understand the capabilities and limitations of any trapping method before use. For instance, traps should not be relied on to reduce or eliminate pest infestations. Also remember that to be effective, traps must be checked on a regular basis — sometimes daily!

■ **Visual inspection:** Certain insects are most easily detected by visual inspections. Billbug adults, for example, can be monitored as they stroll on paved areas and sidewalks in hot weather and a treatment threshold of five to ten insects detected in five minutes can be used. Annual bluegrass weevils can be detected by inspecting the clippings from close-cut turf, and chinch bugs can sometimes be found by separating grass plants with the thumb and forefinger and examining the base of the plant. While visual inspection can be used to detect most insects, it is rarely as efficient as other sampling techniques.



Looking under the turf

■ **Other detection methods:** Standard insect sweeping nets are useful for collecting flying insects in turf areas. Mole crickets in flight have been monitored using sound-trapping stations that broadcast recordings of males. Their damage can be assessed by placing a square frame divided into equal sections on a damaged area, then rating the turf by the number of sections containing mounds or tunnels.

Using sampling information

Sampling provides details about insect population densities, species, and developmental stages. High and low population areas can be delineated for possible spot treatments and damage thresholds used as guidelines in making treatment decisions. While sampling, additional information can be gathered about thatch thickness, soil type and moisture, turf health and vigor, and turfgrass species. These facts can be used to decide if control is necessary and what strategy should be employed. If an insecticide is necessary, the site-specific knowledge gained will aid in the selection of the most appropriate product.

If turf damage is evident but no pests are detected, examine the turf for other causes of injury, such as disease, excessive thatch, improper mowing, or heat or moisture stress. When examining turf, be on the lookout for pests' natural enemies, such as lady beetles, big-eyed bugs, lacewings, ground beetles, spiders, and parasitic wasps. A high ratio of natural enemies to pests is usually best left alone—let nature do the work!

Record keeping and evaluation

Accurate records are essential for the success of a turfgrass pest management program. Keeping the documentation simple will render the process less burdensome.

Sampling and scouting records

During the growing season, day-to-day pest management decisions should be based on scouting information. Effective record-keeping greatly increases the long-term value of this information by providing the turf manager with historical, site-specific knowledge. This information can be used to predict when certain pest problems are likely to occur, both in the current season and in subsequent seasons. In addition, records call attention to patterns and associations that may be overlooked during a pest infestation. Examples include particular turf areas or cultivars that are chronically infested, or insect activity coinciding with drought or disease stress. Pest histories should be reviewed several times each season so that potential problems can be anticipated and initial monitoring efforts focused on historical "hotspots."

Scouting records should be as complete as possible. Note the kinds and numbers of pests present, when and where they were found, and exact locations, and extent of any turf damage or abnormalities observed. Information on the turf species and cultivar development, turf health, and current environmental conditions is also valuable. When recording scouting or

Forcing insects out of the turf

other management information, be as quantitative as possible: record the actual number of insects per unit area; assign numerical ratings to injured turf. Photographs are also an excellent way of documenting and comparing damage.

Control records

Information pertaining to control methods and their results is as vital to a successful IPM program as are scouting records. The combined pest and control information forms the basis for judging efficacy and cost, as well as making future plans. You should already be keeping good records of pesticide use. Compare them with observations of insect activity. Ask yourself: Can your records be enhanced by including sampling and threshold data? Do you follow-up control measures with an assessment of effectiveness? Do you know how much a pesticide application costs (product, labor, environmental effect)? Can you easily access records of other practices and events that affect insects (i.e., fertilization, mowing, temperature, rainfall)?

Assessing the effectiveness of cultural and control practices is an often overlooked but important component of a turfgrass pest management program. In most cases, the same sampling techniques used to detect the original pest infestation can be used to monitor the success or failure of a control strategy. When evaluating the efficacy of a control measure, however, sampling can be limited to only a few previously infested areas. The turfgrass manager can use the evaluation process to differentiate management approaches that were effective from those that need to be modified. At the end of one season, this information can be reviewed in order to plan and prioritize scouting and management activities for the following season.

Pest management options

Sampling and monitoring information can greatly improve your ability to manage insects. The most important benefits are early detection, determining if control measures are needed, and optimal timing of these actions. Pesticide use is often decreased in the process. For example, a turf manager might make successive insecticide applications to control cutworms, reacting every time significant damage is seen. Conversely, forewarned by experience, the same manager might anticipate the problem, sample, then act before injury occurs. Early detection allows treatment of the first infestation of cutworms when they are young and vulnerable, and have yet to cause significant damage. Good control of a parent generation precludes damage from their offspring.

Assessing insect problems before they reach crisis proportions also increases the management options. In the early stages of an infestation, cultural practices such as irrigation, mowing, and fertilization can be manipulated to reduce damage. Additionally, we are entering a new era of pest control, when early detection, proper identification, and proper timing are essential for success of biologically-based solutions. For example, nematodes and microbial products must be applied when insects are young. In addition, various species and strains of these control products must be matched to the exact species of pest insects.

Conclusion

This article contains many practical ideas for fine-tuning your insect management strategies. If you try to implement them all at once, you will be overwhelmed. After all, there's a lot more to growing quality turf than managing insects! Pick out techniques that would have the greatest impact on your most persistant or most severe insect pests. Eventually these practices will become standard, and you will find yourself approaching all pest problems from an IPM point of view. Initial investments of time and labor are paid off in quality improvement, reduced pest management costs, and peace of mind.