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Turf Grass TRENDS

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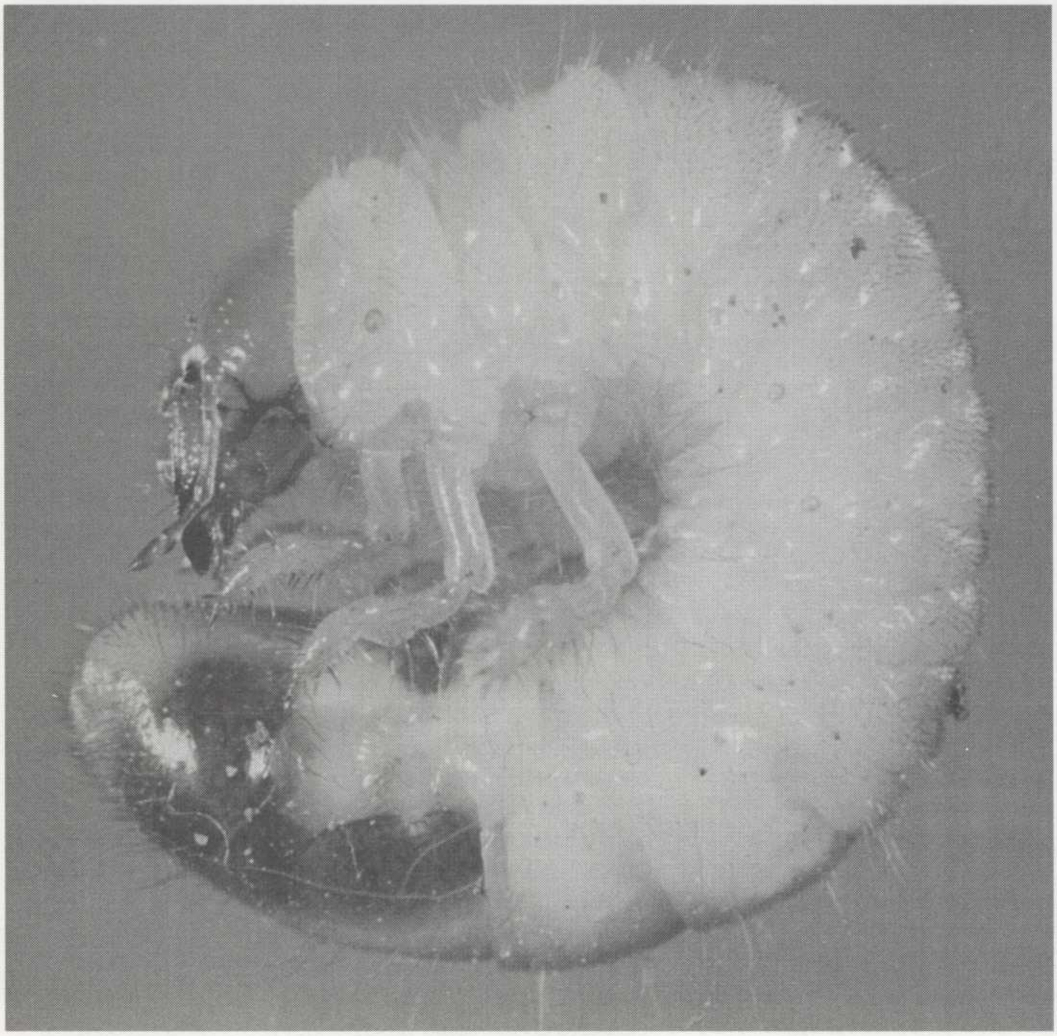

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Cover photo: Japanese beetle grub, about 20 mm in length. Photo provided by Dr. Michael Villani.

Identifying the factors

Predicting grub damage in turf

by Dr. Michael Villani

We undertook a study of 317 lawns in Rochester, New York, in 1990 to gather some of the first large-scale data and formulate protocols that could be used by turfgrass managers to identify sites that harbor grub populations, monitor them and make the appropriate control decisions dictated by what we learned.

Until now, turfgrass managers have been unable make informed decisions prior to applications of potent pesticides (the usual way to deal with the threat of a growing grub population). Until this study, field research could not provide managers with the tools they could use to make informed decisions about controlling this turfgrass pest. Other than the well established, site damage threshold of five to ten grubs per square foot, a threshold that necessitates immediate curative control applications, scant work has been done on providing turfgrass managers with good pest control decision making rules for the control of grubs.

In the Northeast the grubs that threaten turfgrass are from a complex of scarab species:

- Japanese beetle, *Popillia japonica*
- European chafer, *Rhizotrogus majalis*
- Oriental beetle, *Exomala orientalis*

In managed turf sites they have been controlled with one or two applications of an appropriate insecticide, usually on a preventive basis.

These preventive applications have been made by turfgrass managers to prevent the potential for some future unspecified turf damage occurring. They are based on his rough knowledge of grub biology mixed with a very rough estimation of this year's grub populations, but with little regional or site specific information on species or populations.

The field work begins

During the first two weeks of September 1990, in an effort conducted by dozens of people, we sampled 317 residential lawns to establish grub populations and to note site characteristics.

Using a 10-foot grid pattern overlaid on each site, a approximately four-inch (11 cm) round sample was removed from each grid location to a depth of four inches (10 cm) using a golf course putting green cup cutter. Previous work had indicated that these cup cutter samples would provide just as reliable data as the more traditional one foot square samples. They were also easier to handle and caused less damage to the homeowner's lawn. Depending on the size of the residential lawn, from 20 to 180 samples where collected from each site.

Each sample was then examined for the number and species of grubs. Each site was also classified for its characteristics (See Table 1 above.).

We also made a grid map of a typical residential lawn with a representation of the kind of grub population that might have been found and their locations (See figure opposite.).

Table 1

Site characteristics

Characteristics	Parameters
Lawn age	less than or more than 20 years old
Amount of Kentucky bluegrass	less than 30%, from 30% to 60%, more than 60%
Slope	level, sloping, low lying
Thatch	less than 1.5 cm, from 1.5 to 2.5 cm, more than 2.5 cm
Soil type	clay, loam, sand
Shading	less than 30%, from 30% to 60%, more than 60%

Only three site characteristics found significant

When the data from the six site characteristics were analyzed statistically, it was found that only three of them were found to be correlated with grub density. They were:

- lawn age
- shade
- Kentucky bluegrass content.

Lawn age

We divided lawns into two groups: less than 20 years old and more than 20 years old. We found the average grub density for the younger lawns ran from 0.6 to 10 per square foot. The average density for the older lawns was between

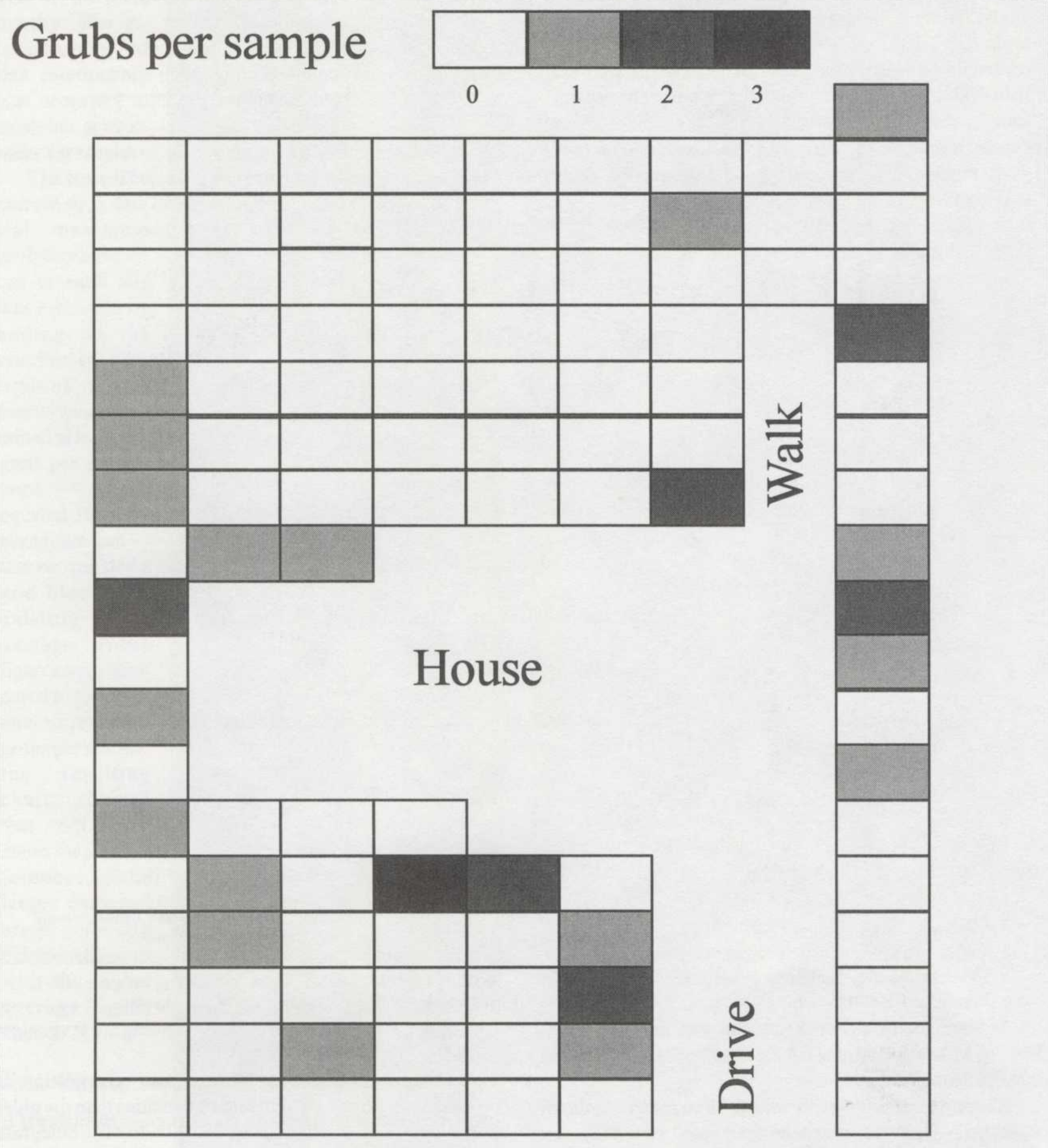


Figure provided by Dr. Michael Villani, Cornell University

Typical house lawn, each block is a 100 square foot area, blank spaces are house, drive and walk.

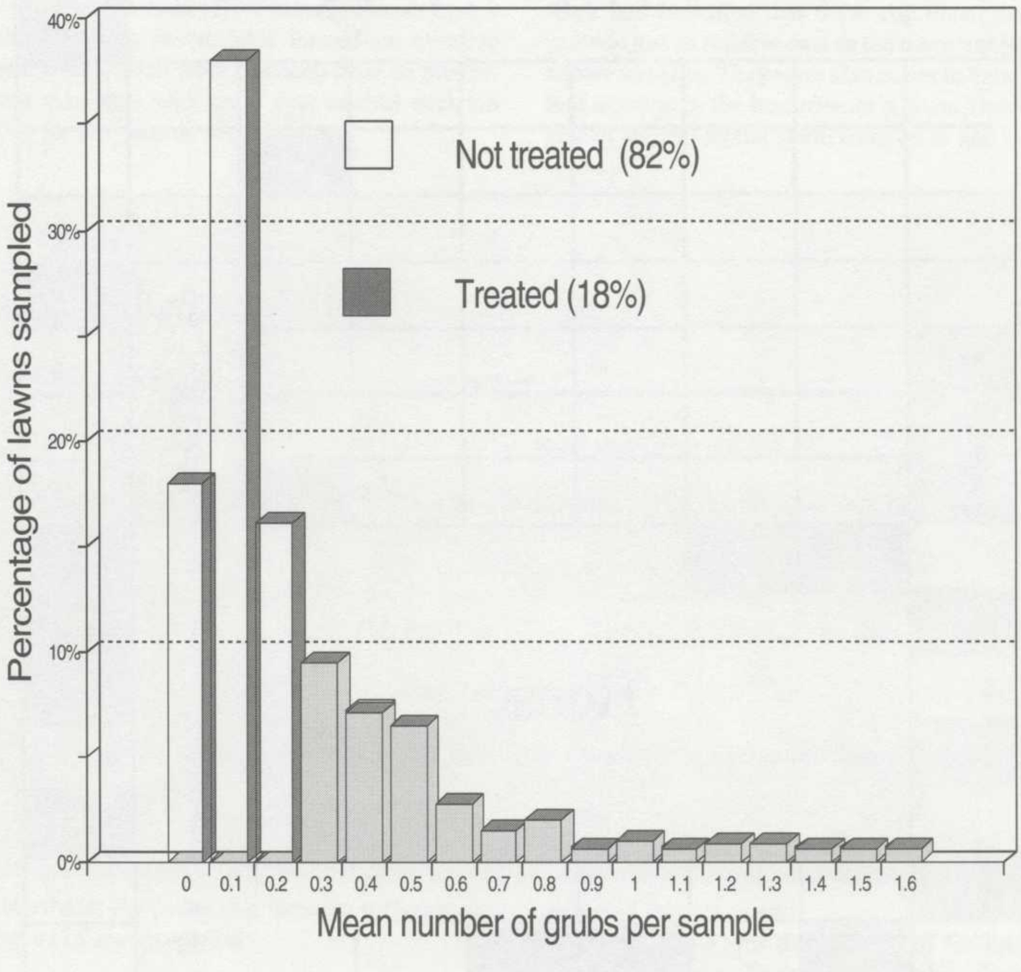
0.2 grubs and 4 grubs per square foot. We found the European chafer grubs, the ones that predominated in the samples, were 2.5 to 3 times more likely to infest the younger than the older lawns.

Shade

We divided up lawns based on the amount of site shading, less than 30%, from 30% to 60%, or more than 60%. We found the sites with more than 60% shade had the lowest grub density. The from 30% to 60% shaded sites had higher grub densities in five of six categories than the more than 60% shaded sites. But the 30% to 60% sites had lower grub densities than the less than 30% shaded sites in five of six categories.

Species composition

When turfgrass species composition was examined in conjunction with the three categories of shade, sites with



This graph shows the percentage of lawns sampled and the number of grubs found, thus providing a treatment threshold.

more than 30% Kentucky bluegrass had higher grub densities in both lawn-age categories. As did those with more than 30% site shading and younger lawns in the from 30% to 60% shading.

The from 30% to 60% bluegrass composition had higher grub densities at both the from 30% to 60% shading and the greater than 30% site shading at both lawn ages.

The more than 30% bluegrass sites and more than 60% bluegrass sites had higher grub densities than the from 30% to 60% bluegrass sites.

A picture begins to appear

When the sites were evaluated so that a set of protocols for turfgrass managers could be made to indicate whether a site is predisposed to high grub infestations, a picture began to appear.

First, sites older than 20 years consistently harbor fewer European chafer grubs than younger lawns.

Second, most sites with high site shading are at very low risk of grub infestation.

Third, all three levels of bluegrass composition at younger sites produced higher grub densities than the older sites when site shading was low. The 30% to 60% bluegrass sites produced the largest number of high grub densities.

Of all the combinations of characteristics, older sites with high shade and low bluegrass content had the lowest grub densities. Younger sites with low shade and high bluegrass content produced the highest grub densities. The difference in grub densities between these two sets of characteristics were as much as 30 times.

Damage and average population density linked

It was necessary to establish a relationship between the size and frequency of observed existing grub damage per site and an overall average per square foot population of grubs, or grub density. The establishment of this relationship was necessary to establish a treatment threshold.

The size of the current or potential maximum grub damaged areas at each site was estimated by adding up the number of contiguous grid blocks which contained at least one grub per sample core — which equaled 10 grubs per square foot — that surrounded a grid block with existing grub damage. These figures were compared to the average number of grubs per site and the resulting chart showed that, with allowances for site differences, the larger damaged areas generally existed at the sites with the higher average grub counts.

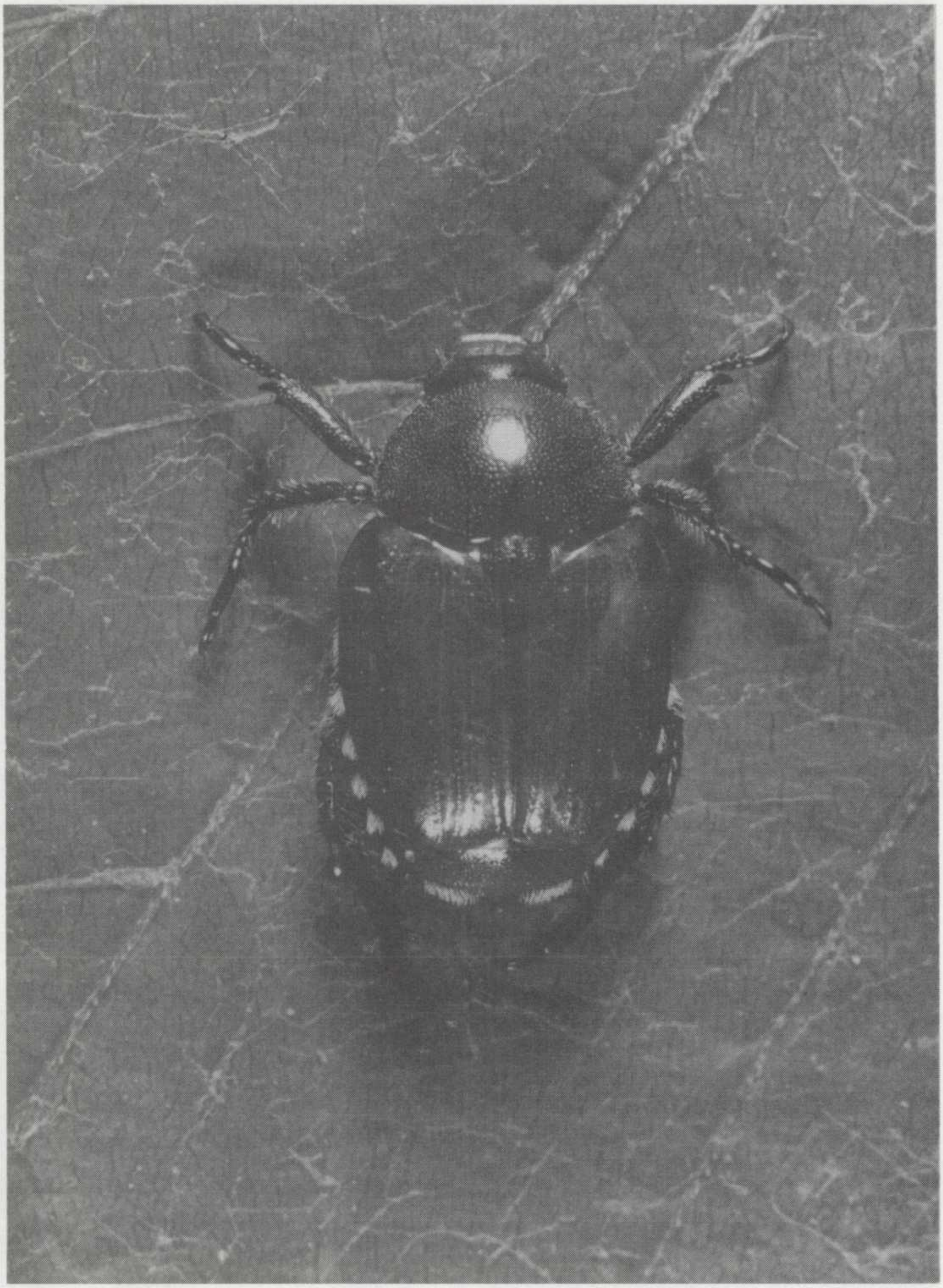


Photo provided by Dr. Michael Villani, Cornell University

An adult Japanese beetle, the final stage in development of this turfgrass pest.

Establishing a treatment threshold

Once the relationship between site grub densities and existing grub site damage was established, it was necessary to establish a range of density values that would trigger a control application.

We showed patch size, as explained above, per site, the actual number of grubs per patch, versus the mean grub density of the whole site on a graph. Both patch size and grub density are expressed on a logarithmic scales (See figure on page 4.).

The number of patches with significant numbers of sample grub counts seems to increase rapidly when mean grub density for the whole site exceeds two to three grubs per square foot. Below that point, the predominant count is one per sample while above that point two or more per sample is in the vast majority. Note that one grub per sample for the areas with existing

Integrated pest management is the future

by Christopher Sann

The Rochester study that Dr. Michael Villani of Cornell University undertook in 1990 represents a milestone in the adaptation of integrated pest management strategies for the turfgrass management industry.

The conclusions and recommendations of this study of grub populations in an urban setting symbolize one of the first steps in the long awaited transition of integrated pest management from an extension service conversation piece into decision-making tools for turfgrass managers.

Most of the work in integrated pest management has been oriented to the research and development of strategies, implementation of demonstration projects and the technical training of those in production agriculture. However, some researchers at Cornell University have been involved in the development of integrated pest management strategies for golf course turf since 1987. The work of these men and women has begun to show some positive results.

1993 golf course work shows results

In 1993, 25 golf courses were involved in the formal integrated pest management turf programs at Cornell and for the second year the participants reduced the number and amount of pesticide applications by more than half, or 54%. Non-integrated pest management golf courses received an average of 212-acre treatments per year, but the integrated pest management group received an average of less than 100-acre treatments per year. The integrated pest management courses ranged from a high of 154-acre treatments per year to a low of 44-acre treatments per year — a reduction in pesticide applications acreage of from 27% to 79% respectively.

These spectacular results were accomplished by the development of specific decision-making tools, such as those that were developed in the Rochester study and then applied in a structured and rigorous way.

This formal integrated pest management monitoring of golf courses has:

- identified a participating high input program golf course as having made at least three unnecessary applications (dicot and monocot herbicides and insect controls).
- found that the application of nematodes produced fair to good control of Japanese beetle grubs in large scale trials, but failed to control Oriental beetle grub populations.
- found that the application of nematodes to control black cutworms at two heavily infested sites produced good control at one site but failed to provide anything more than minimal control at the second.

damage translates into 10 grubs per square foot. At the high end of the existing five to 10 grubs per square foot treatment threshold, and two grubs per sample translates into twice the high end of the treatment threshold. If the suggested all-site treatment threshold is not adhered to, then spot treatments should be made to the areas defined as a patch: any 100 square feet with at least one grub per sample.

Recommended procedures

If confirmed by additional research, this proposed set of decision making protocols will allow turfgrass managers to evaluate individual sites for their potential to harbor damaging grub populations. Once that potential has been established by an analysis of the site characteristics — more than 20 years old, less than 30% shaded, and more than 30% bluegrass content — the study data recommends that the site be sampled for the predominant species present in the region with a minimum of 20 samples selected from random locations in a representative manner for the site and that the samples are taken at least ten feet apart.

If the resulting average grub density exceeds the 0.25 grubs per sample threshold, then the study data recommends that 20 additional samples be taken to confirm the first sampling. If the second sampling grub density confirms the first, then an appropriate insecticide application should be made.

This is the preliminary study

The protocols explained above are at best tentative. They represent only the results of a one year study and present the first attempts at producing protocols.

In order for the 1990 data and analysis be considered to be accurate for more than just that year, we are required to repeat the study to confirm our proposed protocols for grubs. Later this summer, the study will be repeated on a smaller number of lawns in a different area of New York state. As the analysis of the new data is checked against the 1990 data, the proposed protocols may be revised. ■