

ESTABLISHING TOLERANCE LEVELS (“ACTION THRESHOLDS”)

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Introduction

In an Integrated Pest Management (IPM) program, a golf course superintendent needs to identify the most critical pests and determine what population density of each pest will cause unacceptable levels of damage. This approach relies on managing pest populations to keep them below damaging levels, and does not attempt to eliminate pests.

Tolerance levels or action thresholds can be developed for agricultural crops by studying the effect of an insect or pathogen or weed on the ultimate yield of the crop. These studies look at several different population densities and measure the ultimate yield. Scientists can put a real number on the impact of the pest (e.g., 10 caterpillars per plant reduced the yield of potatoes by a certain number of pounds per acre) and then calculate the cost of managing the pest population so it would not become high enough to cause measurable damage.

But in golf course management, it is virtually impossible to put a dollar figure on the damage incurred by a pest. How many mole crickets per square foot will result in a reduction in the number of rounds played per month? How many dollar spot marks will result in complaints from the membership?

We use a slightly different term for making decisions about the need to reduce a pest population in golf course turf. We refer to “tolerance levels” (how many is too many?) or “action thresholds” (when will the pest activity become serious enough to require action?). There are

several factors that dictate whether you will reach or exceed your tolerance level. Many of them have to do with the agronomic conditions, while others are more subjective. Tolerance levels are very site-specific. Usually there are different thresholds throughout the property, and those thresholds may change throughout the year.

Stress management is a key component of an IPM program. In essence, managed turf can usually handle one or two stresses, but it cannot handle three or four stresses at the same time. If various agronomic conditions are not optimal for the turf stand, a relatively small pest population may cause damage that would not be noticed in a healthier or less stressed stand. If you can provide the best conditions possible for the turf to grow, you often can tolerate some pest activity (or activity will be minimized) without causing disruption to the playing surface.

Vigor and condition of turf

Water

Is the golf course in an area where seasonal precipitation is very low – or where summer rainfall has become less predictable? Is there an adequate water source to be able to irrigate as needed? What is that water source, and is it dependable? Is the quality of the irrigation water good or is the salinity high? Any conditions that compromise the quality of the water can impose stress on the turf, thereby reducing your tolerance for pest activity.

Drainage

Many turf diseases thrive in conditions where soil moisture remains high, so it should be no surprise that inadequate drainage systems often lead to increased disease activity, sometimes resulting in the need to use fungicides to manage the disease. Invasive crane flies also prefer wet soil conditions, particularly when they are laying eggs or eggs are hatching. Areas with poor drainage often see greater damage from crane fly larvae.

Mowing

Mowing is an essential part of maintaining preferred playing conditions on golf courses. Different playing surfaces are mowed at different heights. Lower heights of cut, which are common on putting greens, impose stress on the turf by reducing the amount of photosynthetic surface available for the plant and often result in reduced root growth. In general, turf being grown at the lowest heights of cut (putting greens, collars, approaches, tees) will have a lower tolerance for pest activity, in part because the plant is under more stress so the “margin for error” is smaller.

Another aspect of mowing that is sometimes overlooked is the importance of keeping the mower blades sharp. Dull blades can tear the leaf surface rather than cutting it sharply. The ragged cut predisposed the plants to infection by various pathogens.

In addition, it is important to change the mowing pattern regularly wherever possible, so the mowers are not making turns in the same place every day. (This reduces compaction in those locations, which is a form of stress management.)

Nutritional level

Turfgrasses have nutritional needs that must be met to ensure healthy turf. Warm season grasses and cool season grasses vary considerably in the seasonal timing – and amount – of fertilizer that is optimum for growth. An IPM plan provides an optimum fertility program, particularly with nitrogen (N), phosphorus (P), and potassium (K) for the grasses you are maintaining. Do not overfertilize! Many fungal pathogens are favored by high nitrogen levels, while others thrive in low nitrogen conditions. Keeping the fertility well balanced for your conditions will enhance the health of the turf and enable it to withstand pressure from some pathogens.

Shade and air circulation

One of the best IPM tools can be a chainsaw! Often areas of a golf course that appear to have the weakest turf are locations that have thick tree lines, heavy shade, and poor air circulation. “Indicator greens” (greens that show evidence of damage from a disease or insect before other greens) often are in sites with many trees casting heavy shadows. The shade reduces photosynthetic efficiency and the reduced air flow often results in increased pathogen activity. There are several commercial software programs and apps that help identify seasonal distribution of shade and can a superintendent recognize areas where tree removal or pruning could be most beneficial.

Large fans placed on the periphery of greens surrounds can provide air circulation and perhaps even reduce fungal activity , but fans can be loud and are not usually very attractive!

Soil types

Some greens are constructed with additional sand, to enhance water movement through the soil profile. But many golf courses are built using the native soil for the rest of the course. These soils may be very heavy (high levels of clay) or very sandy or somewhere in between. Heavy soils tend to retain moisture longer, which can lead to increased disease activity. Sandy soils tend to lose moisture quicker, which can lead to drought and heat stress. Know your own conditions, and know where the trouble spots are.

How thick is the topsoil layer? Are there “veins” of clay in certain locations that would benefit from improved drainage? Are there pockets of sand or sandy loam that tend to dry out more quickly? Are there underlying rock ledges, just beneath the surface, that lead to localized dry spots?

It is important to know the soil pH throughout the golf course as well. Most turfgrasses prefer to grow in soils with a pH between 5.6 and 6.5. If your soil pH is well above or below this range, the turf can be affected. Also, nutrient availability is greatly affected by pH, so some macronutrients and micronutrients will be much less available in soils with a pH outside the optimum range.

Thatch management

Thatch provides excellent protection for many insect pests, including caterpillars, chinch bugs, and billbugs. Managing thatch so it is neither too thick or too dense will help put those insects at a disadvantage and may enable you to raise the threshold for that insect.

Turfgrass species and cultivars

Warm-season grasses and cool-season grasses have very different characteristics, and thrive at different times of the year. Briefly cool-season grasses grow best in spring and fall, struggle with high temperatures in the summer, and go dormant for the winter months. Warm-season grasses thrive in high temperatures, but go dormant in the winter. (Many courses growing warm-season grasses will overseed the playing surface with a cool-season grass in the fall to provide color throughout the winter months, when the warm-season grasses are not growing actively.)

Be sure you are growing turfgrass species that are well adapted to your local conditions. Creeping bentgrass is not well adapted to coastal conditions in the Gulf states. Yes, it can be “maintained” but the savvy superintendent will recognize that chemical inputs will be much higher than they would be for a fine-leaved bermudagrass. Similarly, many cultivars have been developed in both warm- and cool-season grasses that have some level of resistance or “tolerance” to certain turf pathogens. If those cultivars match your local conditions, incorporate them into your agronomic plan. At the very least, consult the National Turfgrass Evaluation Program (NTEP) reports to determine which species and cultivars are best adapted to your conditions.

Some insects are more damaging on certain grass species than others. For example, the annual bluegrass weevil (ABW) causes much more damage on annual bluegrass greens than creeping bentgrass greens in the northern half of its range. In these areas the tolerance level for ABW is much lower on annual bluegrass than on creeping bentgrass.

Pest species present (or combination of pests)

Your tolerance for pest activity will depend in large part on the pest species that are present. For example, many species of annual white grubs cause damage to turf roots. But there are differences between the species. European chafers tend to be much more damaging than Japanese beetles, so your tolerance for European chafers will be much lower than it would be for Japanese beetles.

If more than one pest is active at the same time (for example, annual bluegrass weevils and anthracnose), the damage from each can be compounded so your tolerance for each would be lower than it would be if only one were active.

Turf use

Golf turf includes putting greens, greens surrounds (collars, approaches, and bunker surrounds), fairways, tees, roughs, and in some cases, native grasses in out-of-play areas. In general putting greens are mowed at the lowest height of cut, are more susceptible to damage from various pathogens and insects, and are less able to recover from damage because of the reduced photosynthetic surface. In addition, half of the game takes place on or near the green, so the golfer perceives the green to be the most critical part of the playing surface. For these reasons,

the tolerance for pest activity usually is much LOWER on the green than on other parts of the course.

Some superintendents consider fairways to be the next most critical part of the lay-out, so their tolerance for pest activity would be lower than for tees or roughs. Others consider tees to be as important as fairways, in part because even footing is crucial and the tee box often provides a visual set up of the hole. In most cases, tolerance for pest activity is HIGHEST on roughs.

Topography (direction of slopes)

In the northern hemisphere, slopes that face to the south receive more direct sunlight and are warmer than slopes that face to the north. This is particularly noticeable in late winter when snow melts more quickly on the south-facing slopes. Because the soil (and thatch) are warmer throughout the year on south-facing slopes, insects, pathogens, and weeds develop more quickly. Sometimes these areas are warm enough to experience heat stress, which means a lower pest density is likely to cause damage than in cooler locations (i.e., your tolerance level would be lower).

Time of year / recuperative potential

What time of year does the pest cause damage? If you are managing cool-season turf and the pest is active in the spring or fall, the grass is naturally growing more vigorously and may be able to withstand some pest pressure without visible damage. But if the pest is most active in the summer, the tolerance level will be much lower because the turf is much less able to recover during the hot summer months. For example, the tolerance level for annual bluegrass weevil larvae feeding on annual bluegrass in the Northeast is usually between 40 and 60 larvae per square foot in June, but only 20 to 30 larvae per square foot in July or August.

If you are managing warm-season turf, the grass naturally grows more vigorously in late spring, summer, and early fall. If a pest is most active in late fall, winter, or early spring, the tolerance level may be quite low, since the grass is dormant and not able to withstand the added stress of a pest.

Expectations of golfers / owner / greens committee

A superintendent may find that the expectations or demands of the golfer will impose restrictions on setting tolerance levels. If golfers are demanding pristine conditions, a superintendent may have to lower his or her tolerance level for certain pests, especially ones that cause distinctive visible damage. However, providing “pristine conditions” is often unattainable due to budget constraints or other factors, so a superintendent must be able to discuss management options – and realistic goals - with golfers, greens committees, or owners.

One superintendent in the metropolitan New York area explained to his membership that he could oversee a couple greens that had been damaged by a fungal pathogen instead of spending thousands of dollars on fungicides. He showed how much money would be saved, and explained that the greens would play just as fast and true as the sprayed greens. The golfers declined, and directed him to apply the fungicides instead. It is difficult to “communicate” and change the minds of people with a “perfect turf all the time” mindset!

Many superintendents experience the “Augusta syndrome” every spring. Golfers watch The Masters on television and then ask the superintendent why their course does not present the same playing conditions. The Augusta National maintenance budget is an order of magnitude higher than that of many courses around the country, so of course there are some strategies they can employ that are not an option for other courses.

Tournament schedule

If you are hosting a tournament, whether a PGA or USGA event or your member-guest, your tolerance for pest activity just before the tournament and the week of the tournament clearly will be lower than it might be at other times of year. You need to be familiar with your pest complexes, and know which pests might be active at that time. In many cases a preventive application of a suitable pesticide will be needed before the tournament to ensure the population remains below the damaging level.

Availability of curative options

Some insect populations can be reduced after they have become active by using a fast-acting insecticide. Similarly, some fungicides are effective against fungi after they become active, and some herbicides kill weeds after they have germinated and emerged. All of these approaches involve using a “curative” product, one that will reduce pest activity after damage becomes visible.

If you do not have curative products (either they do not exist or they are not labeled in your state), you will have to rely on preventive applications. And because your options for “cleaning up a mess” are limited if you do not have curative options, your tolerance for pest activity may be lower from the beginning of the growing season.

Visibility of the site

Some areas of the golf course are highly visible from the clubhouse or are “signature holes” that provide an especially striking visual image. Many superintendents, greens committees, members, and club officials consider these locations to be particularly important to provide a pleasing aesthetic effect, so they are less tolerant of pest activity in those areas.

Budget

The maintenance budget will have a direct impact on IPM strategies. If the budget is limited, some pest management options (for example, some biological control products, extensive tree removal) will be unaffordable. The superintendent must prioritize the most critical needs for the maintenance plan, and concentrate on those. Courses with more robust budgets can experiment with some of the newer management strategies, including new active ingredients in pesticides, biological control options, and cultural manipulations.

Environmentally sensitive areas near by

If you have environmentally sensitive areas on the golf course, you may be limited in the kinds of strategies you can employ to manage pests near those areas. At the very least, you must be aware of environmental characteristics of the pesticides you want to use. In general, you may want to avoid pesticides that are highly soluble, because they are more likely to leach or run-off after application. Are the soils sandy, increasing the likelihood of leaching to underlying

groundwater? Are there steep slopes that will funnel materials toward a wetland or pond? If you have any of these kinds of situations, your tolerance for pest activity in the vicinity will almost certainly have to be higher than it might be in other parts of the golf course, because you may not have as many chemical options available to management the pest population.

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