

WHY PESTICIDES SOMETIMES FAIL

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INTRODUCTION

Golf course superintendents sometimes must rely on pesticides to manage populations of various pests – perhaps an insect feeding on the roots of the grass, a fungal pathogen causing a debilitating disease, or a weed encroaching onto the playing surface. These pesticides are chemicals that are designed to kill particular kinds of pests (e.g., broad-leaved weeds) and have certain chemical and physical properties that dictate how they should be used. Sometimes a pesticide application does not provide the level of “control” of the pest that the superintendent had expected, or hoped for. This fact sheet explains some of the questions that should be asked when trying to determine whether a pesticide “failed” or not.

DID THE PRODUCT REALLY FAIL?

If a pest population was not sampled before the application was made, there is no way to know what the population was before the application, so you cannot compare that to the population after the application. For example, it is not unusual to have 30 to 40 white grubs per square foot in some turf areas in New England. If a person applies a grub product to such an area without actually counting the grubs at the time of application, and later returns to the treated area and finds 8 grubs per square foot, he or she might think the product did not work very well. In fact, if there were 40 grubs per square foot at the time of the application, the insecticide killed 80% of the grubs – which is pretty good!

Have a good sense of the pest population before you apply a pesticide. Quantify the density of the population (take a series of insect samples, take pictures of the density of dollar spot or weeds in a known area) before you treat. That way, you have something to compare to when you take a look at the population after the application

DID YOU HAVE AN ACCURATE IDENTIFICATION OF THE TARGET PEST?

Some pest insects resemble beneficial insects (e.g., big-eyed bugs look very much like chinch bugs but actually prey on chinch bugs). There are several species of white grubs that can damage turf, and some species (e.g., European chafers) are much less susceptible to insecticides than other species – so which species of white grub you have really does matter. Many diseases have very similar symptoms, but each responds to fungicides very differently, so what may work on one pathogen may not have any impact on another pathogen. Several of our fungicides, herbicides, and insecticides are quite specific, and will not reduce populations of every pathogen, weed, or insect. Some superintendents thought they had an anthracnose infestation but the damage was actually caused by annual bluegrass weevils. No fungicide will control annual bluegrass weevils!!!

Be sure to monitor the affected area, collect appropriate samples, and get confirmation of the pest species from a reputable diagnostic laboratory that specializes in turf samples or from your local Extension turf specialist.

DID YOU USE THE “RIGHT” PESTICIDE FOR THE CIRCUMSTANCES?

There are many pesticides available for use on turf, including traditional chemicals, biological control alternatives, and “organic” products. Each of these products has its own characteristics. Some of the most critical characteristics to consider are:

Does the product bind to thatch or move through it?

Some turf insects (e.g., white grubs, mole crickets) are active in the soil. If a pesticide is tightly bound to the thatch, it may not be able to penetrate the soil and reach the target insect. Likewise, some turf insects are active primarily in thatch (e.g., chinch bugs, young billbug larvae, several species of caterpillars), so a product that remains in the thatch might be a good choice.

How soluble is the product?

Some pesticides are highly soluble in water (e.g., acephate, carbaryl, trichlorfon). These products will penetrate thick or dense thatch much more easily and are less likely to remain in the thatch. Highly soluble pesticides are also more likely to runoff or leach from the site of application.

How quickly does the product begin to “work” (become active against the pest)?

Some pesticides begin to work quickly (within a day or two after application, sometimes even more quickly) and are often called “curative” products. They can be used after pest activity becomes apparent. Sometimes these products work quickly but also break down quickly, so if the pest population is present in several different stages of vulnerability (e.g., pupae; eggs; small, medium, and large caterpillars present at the same time), the pesticide might break down before some of the stages are present in a susceptible form.

Some pesticides take several days or even a couple weeks to become active in field conditions. For example, chlorantraniliprole is most effective against white grubs if it is applied 60 to 90 days before the young grubs begin emerging in the summer. Many of the turf pesticides used on golf courses are “preventive”, intended to be applied before the pest population becomes active. Be sure to allow enough lead time when using those products, so they will be releasing the active ingredient at the same time the vulnerable stage of the pest is present.

How long does the product remain active in field conditions?

Some of our turf pesticides remain active for several weeks or even a few months, but others break down in a matter of a few days or a couple weeks. If a pesticide breaks down quickly, a turf manager needs to recognize that the curative application (intended to “cure” a problem) will not remain on site for very long. Well timed curative applications can be extremely effective, especially against certain insects and pathogens, but those products do not last forever!

If you are making a preventive application (e.g., a fungicide to be applied before the fungal pathogen becomes active), you might want a longer-lasting product. If you are targeting an insect

(e.g., black cutworms) that is already feeding on your turf, you might want a product that releases and becomes active relatively quickly. If you are targeting an insect or a pathogen that is active in the soil, you may want to avoid products that are readily bound to thatch. Herbicide applications are often described as “pre-emergent” (applied before the weed germinates, hence a preventive application) or “post-emergent (applied after a weed germinates, hence a curative application). Be sure you know which approach is supported by the pesticide you plan to use.

DID YOU TIME YOUR APPLICATION WELL?

Most insects have a few developmental stages (e.g., eggs and pupa) that are virtually invulnerable to insecticides. However, small immature (larva or nymph) stages often are quite susceptible to insecticides. Ideally, an application should target pest insects when they are in those small, most sensitive stages. If you apply a soil insecticide when white grubs or mole crickets are already nearly full-grown, that product is not likely to work very well because the insects are much less vulnerable.

Not everyone has the luxury of timing every pesticide application perfectly. If an application must be made (because of logistics or scheduling difficulties or weather challenges) early in the period when a turf manager expects a pest problem to develop, he or she probably should use one of the slower-acting, but longer-lasting, materials. On the other hand, if an application is made after the pest population has become established, a faster-acting material probably might be a good choice.

Timing of a pesticide application includes considering the life cycle of the pest and applying when the pest is most vulnerable. In addition, some insects are nocturnal so late afternoon or evening applications tend to be more effective. For example, the caterpillars of many sod webworms and cutworms are active primarily at night, and remain in their burrows during the day, well away from insecticides and temperature extremes. If a turf manager can apply a caterpillar control in the evening, the material will be markedly “fresher” and more effective when the caterpillars come to the surface that night to feed.

Lesson – Know the life cycle of the pest and when it is most susceptible to the action of the pesticide you are planning to use. In addition, note whether there are any situations where time of day of the application can make a difference.

DID YOU USE THE RIGHT AMOUNT OF CARRIER (WATER) DURING THE APPLICATION?

Most pesticide labels include directions on the amount of water per unit area (e.g., 2 gallons per 1,000 square feet). These mixing instructions are included for a reason, and failure to follow the directions can lead to pesticide failures. While it can be tempting to use less water (because you can cover a larger area before returning to the mixing and loading station to reload), lower water volumes sometimes have a significant detrimental impact on the effectiveness of the product. The performance of several fungicides and insecticides is directly correlated with using proper (adequate) spray volumes.

DID YOU WATER THE TREATED AREA APPROPRIATELY (BEFORE AND AFTER)?

Many pesticide labels include wording about use of water after an application. While the labels usually do not stipulate a particular amount of water, they may provide some guidance. Several university turf researchers have studied the effect of post-application water on the efficacy of pesticides against various pests. For example, most of the insecticides that are used to target annual white grubs should be watered in with at least 0.1 inch of water (0.25 inch is even better) as soon as possible after an application (and usually within 24 hours). The water helps move the product down toward the thatch, and induces some of the grubs to move into the thatch from the soil, thereby increasing contact of the insect with the insecticide.

If soils are particularly hot and dry at the time of application, some target insects (e.g., annual white grubs) might migrate downward in the soil profile to avoid the heat and dry conditions. Applying an insecticide to target those grubs would be a waste of time and material, because the grubs are well below the chemical and are not likely to come in contact with it. But if a superintendent waters that area about 24 to 36 hours before the scheduled application, the grubs will be tricked into moving upward in the soil profile. This greatly increases the effectiveness of the application, because the grubs are back in the target zone.

Post-application water is also important for some fungicide applications. For example, some products that are used to target root pathogens should be watered in to help move the fungicide closer to the target zone. Some fungicides are more effective if they are NOT watered in, but instead are allowed to dry on the leaf surface.

Carefully follow the label instructions and current Extension turf guidelines for your state for post-application irrigation! Those guidelines have been developed to enhance the efficacy of these products in a variety of conditions.

DID YOU CHECK THE pH OF THE WATER BEFORE AND AFTER MIXING THE PESTICIDE IN THE TANK?

Some pesticides (including acephate, carbaryl, and trichlorfon) are vulnerable to alkaline hydrolysis (literally chemical breakdown in water with a pH higher than 7). The higher the pH, the more quickly the breakdown reaction occurs. In fact, if the water pH in the tank at the start of the mixing process is 8.0, trichlorfon will break down in less than 75 minutes. Some formulations of some of the chemicals that are sensitive to alkaline hydrolysis have inert ingredients in the formulation that help mitigate hydrolysis, and may lower the pH of the mix. There are products you can use to lower the pH to acceptable levels or to buffer the reaction.

WAS THE “APPLICATOR ERROR”?

Did you calibrate the sprayer or spreader?

If the application equipment has not been calibrated, it is unlikely that the amount of material applied was correct. Sometimes miscalibration results in overapplication (too much product, risking contamination of the environment and

wasting money). If the miscalibration results in underapplication, then there may not be enough of the pesticide available to target the pest.

Application equipment must be calibrated several times a season. Every time a sprayer is use, nozzles experience wear and tear. Some formulations lead to corrosion of nozzles, directly impacting their actual delivery rate. Some formulations can clog nozzles, further compromising an accuracy of an application.

Did you measure the spray distribution pattern from your nozzles in field conditions?

It is important to check the actual distribution of spray droplets from the sprayer. If nozzles are not set just right on the boom, some nozzles may be turned slightly toward others, resulting in an overapplication in those areas. If some nozzles are bent slightly away from their neighbors, this can result in an underapplication in the pattern, similar to skipping an area.

You can buy small cards that are treated with a film that reacts when it comes in contact with water. Place those cards on a flat turf surface (and secure to the ground if it is windy!), and run the sprayer over the area. Many superintendents have been surprised to see how inconsistent the water delivery is with their sprayer configuration. If you find the application has “dry” spots or “wet” spots, check all the nozzles and adjust them as needed.

Were there any “skips” in the application?

Sometimes an applicator forgets to turn on the sprayer for one pass, or perhaps operates the unit in such a manner that there are gaps between treated areas. These “gaps” or “skips” are sometimes noticed after the application, when damage from the pest becomes visible in the skipped areas.

HOW LONG HAVE YOU HAD THE PESTICIDE IN YOUR STORAGE AREA?

Pesticides do not last forever, and have a finite shelf life in storage. While the shelf life varies, many products will begin to lose efficacy if they are stored for more than 18 to 24 months. (Note that some materials lose effectiveness even more quickly.)

In addition, humidity and extreme temperatures can have an adverse effect on pesticides. Pesticides should be stored in secure areas where the temperature does not drop below 40° F and does not go above 85° to 90° F.

HOW MANY PRODUCTS DID YOU HAVE IN THE TANK? WAS THERE ANY INCOMPATIBILITY?

Some superintendents like to combine two or more chemicals (pesticides, fertilizers, and other plant health products) in one application. This obviously can save time and money, and reduce wear and tear on the equipment and the turf. But some products are not compatible with others, and combining these products can reduce the effectiveness of one or both products. Check with your chemical sales representatives to determine whether the combination you are considering makes sense.

Also note the language on the label. Some labels specifically prohibit tank mixing certain pesticides with certain kinds of fertilizers. So, don't do it!