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MANAGEMENT PRACTICES TO MINIMIZE DISEASE PROBLEMS*

*Howard D. Ohr***

Growing turfgrass, whether on a sod-farm, athletic field, or home lawn, is different from all other types of horticultural and agricultural practices. A typical lawn consists of dense populations of millions of individual plants of similar genetic characteristics growing under similar environmental conditions.

No other crop receives the abuse or attention that many turfgrass plantings receive. They are frequently mowed, heavily watered, fertilized, inundated with pesticides, verticut, compacted, and aerated. They are attacked by diseases, insects, nematodes, trampled on, and invaded by weeds. Through all of this they manage to survive and flourish.

Because of their similar genetic makeup, the individual plants in a given turfgrass planting should be similar in their susceptibility or resistance to diseases. This applies to plantings made up of one variety of grass and not to plantings of mixed varieties or species. Only those plants of a given variety or species would exhibit this similarity, unless attacked by a pathogen capable of infecting the other varieties or species.

In such a monoculture it would seem that the introduction of a pathogen capable of causing a disease on that variety would proceed immediately to destroy the entire planting. This is not usually the case, however, because for a disease to develop not only must the host be susceptible and the pathogen be present, but the environment must also be favorable. Specifically, the micro-climate, soil factors, and cultural practices that make up the turf environment must be considered.

These components of the environment do not usually act independently, but arc part of an interrelated complex that operates to the advantage of the pathogen or to the disadvantage of the host during disease development.

Characteristically, a given grass planting does not contract every disease it is susceptible to, nor is it attacked by a different disease every year. Usually, a history of disease develops where a single disease or a few diseases occur on a particular planting from year to year. A thorough knowledge of what diseases occur on that grass, the time of

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year they normally appear, the weather conditions that precede their development, the cultural practices that can lessen their impact, and what chemical control methods can be used to prevent their appearance or inhibit their progress can contribute a significant amount to maintaining healthy turf.

Some of the environmental and management factors to be considered are: temperature, irrigation, fertilization, soil reaction (pH), mowing, aeration, vertical mowing, and pesticide application.

Temperature

Both the host (grass) and the pathogen are affected by temperature. All types of grass have a temperature range in which they grow most vigorously. In this range they are most resistant to many pathogens; below or above their optimum temperatures they become more susceptible.

The pathogen also has an optimum temperature range but may be able to grow sufficiently above or below this range to produce a serious disease problem.

A classic example is the influence of temperature on the seedling blight caused by the fungus *Gibberella zeae* on wheat and corn (both grasses). With either host, the fungus is least pathogenic at that host’s optimum growth temperature. With wheat, a cool season crop, the disease develops best above 68” F; with corn, a warm season crop, the disease develops best below 68° F (Walker, 1957).

In turf situations, many fungi are active at temperatures that may stress the host plants. Several fungi, known as snow molds, are active under a blanket of snow. The fungus *Pythium* is capable of rapid growth and spread during hot (85 to 95° F), humid weather when cool season plants are under stress. The disease spring dead spot evidently occurs when bermudagrass is dormant.

The most effective means of minimizing the effects of temperature on disease development is to choose the grass species and varieties best adapted to the area.

Irrigation

Water is the most important single factor governing disease occurrence and severity in California because of its influence on the growth and development of the pathogen, the host plant, and related microorganisms. In California it is one of the few factors that can be controlled, because rainfall occurs only in winter and early spring. Since most fungal diseases occur in late spring and summer when irrigation is required, a great deal of control can be exerted by practicing proper irrigation procedures.

Most fungal pathogens need free water or a very high relative humidity to germinate, grow, or infect the host plant. Water movement over the surface of the grass helps spread some pathogens. For example, the *Pythium* fungus thrives during warm, wet conditions. It grows rapidly and releases its zoospores, which are capable of swimming in water to new plants. More importantly, the movement of water over the grass surface rapidly moves these spores over wide areas, where they infect more host plants.

Pathogens are also aided by the presence of water or high relative humidities over a long enough time for them to infect the plant. For most fungal pathogens of turfgrass, the time required is 18 hours or more.

Water applied in the late evening or at night often remains on the foliage for long periods, giving the pathogen the maximum opportunity for infection. Water applied in the early morning usually dries rapidly from the foliage, preventing the pathogen from becoming established. Frequent, shallow irrigations should be avoided.

Removing water and guttation droplets from grass blades by sweeping the greens with large brushes, by dragging hoses across them, or by other means has proved to be effective in reducing the severity of *Rhizoctonia* brown patch on golf courses (Couch, 1962). Syringing may also be effective.

Too much water on the host plants may increase their succulence or may stress the plants by preventing oxygen uptake by the roots, both resulting in increased susceptibility to disease.

Helminthosporium leaf spot is more severe in drought-stressed areas of a lawn than in areas receiving adequate irrigation (Endo and Colbaugh, 1972), because moisture affects disease development in a third way. This effect is not on the pathogen or on the host, but on the microorganisms associated with the turfgrass community. For example, Endo and Colbaugh (1972) found that, when thatch is allowed to dry and is then remoistened, the microorganisms on it are greatly reduced, and the thatch leaks more sugars and amino acids than normally. *Helminthosporium* utilizes these nutrients in the absence of the competing microorganisms and grows rapidly to become a problem.

Drought stress also favors *Fusarium* blight, a disease most common and severe on bluegrass. Because drought-stressed areas usually result from compacted soils, the stressed area should be aerified.

Fertilization

The effects of fertilization on disease development vary with the disease studied. Some diseases are more damaging when the turf is grown under higher or lower than normal levels of nitrogen. Brown patch caused by *Rhizoctonia solani* is more severe if nitrogen levels are too high while phosphorus and potassium levels remain normal. Increasing all three elements does not increase disease severity. If, however, all three are lower than normal, disease severity is greater than when the plants receive balanced nutrition (Couch, 1962).

The effects of *Sclerotinia* dollar spot are more severe on nitrogen-deficient turf and may be reduced by increasing nitrogen fertilizer to adequate levels. This reduction is due to an increased growth response by the plants (Couch, 1962).

Highland bentgrass is less susceptible to *Pythium* blight at a low balanced fertility level than at normal or high nutrition levels. When deficient in calcium, however, the plants are more susceptible (Couch, 1962). From these few examples, it is easy to see that fertility levels affect disease severity in different ways depending on the disease and fertilizer element involved. With a knowledge of the diseases that occur on a given turf, when they occur, and their response to different fertilizer levels, the turf manager will be able to adjust the fertilizer program to help minimize the effects of that particular disease.

PH

A given disease may also vary in its severity under acid or alkaline conditions. In the case of *Rhizoctonia* brown patch, pH does not affect disease development under low nitrogen fertility conditions. The disease is more severe in the acid range at normal balanced fertility levels, but more severe in the alkaline range at high nitrogen fertility levels (Couch, 1962).

Sclerotinia dollar spot is unaffected by pH, but turfgrass grown on soil with an acid reaction is more resistant to *Pythium* blight.

A knowledge of how soil acidity or alkalinity affects development of a disease may enable the turf manager to adjust the pH by soil amendments. These changes in soil reaction in conjunction with other practices could reduce the severity of the disease or help prevent its occurrence.

Mowing

Removal of foliage by mowing affects the grass plants in several ways. It provides a great number of wounds through which a pathogen may infect the plant. For example, it is thought that brown patch caused by *Rhizoctonia solani* is more severe on short-cut grasses because of the mowing wounds (Couch, 1962).

Removal of photosynthetic area may decrease disease resistance. This is thought to be due to a lowered sugar level, because available sugars are used by other plant parts, thus lowering the level of disease resistance. Bluegrass plants mowed below 1.5 inches show a marked increase in incidence and severity of diseases caused by *Helminthosporium* (Endo, 1972).

Mowing turf at the maximum height allowable for its particular use should cause less depletion of the plant's food reserves, allowing the plant to remain more resistant to the disease.

Aeration

Used to reverse the effects of compaction by allowing a better exchange of oxygen and better water penetration, aeration probably aids a plant in its disease resistance by enabling it to maintain a more vigorous growth.

Vertical mowing

The main purpose of vertical mowing is to remove thatch from beneath the surface of the growing grass. Thatch, if thick enough, can prevent the plants from being rooted in soil and can restrict the movement of water, nutrients, and air to the roots. Thatch also provides an excellent food base on which weak pathogens can become established and attack the growing plants. Removal of thatch reduces this food base, thereby reducing the opportunity of the pathogen to produce disease.

Pesticides

In an intensive crop situation, pesticides must be considered a part of the environment. Their effect on turfgrass diseases is not known, but it has been shown that several insecticides increased infection of vegetables by *Helminthosporium sativum, Pythium ultimum,* and *Rhizoctonia solani,* three pathogens that also attack turf. Herbicides can also predispose turf to, diseases. It is not inconceivable that pesticides make a difference in severity of a given disease. If a pesticide is applied to a diseased area, it should be observed closely and the effect noted. This information could then be used in management of the disease.

These are just a few simplified examples of environmental and cultural effects of the different parameters on the physiology of the host and pathogen and on the associated microbial community. For a review of these parameters, see Endo (1972). To determine the probable effects of environmental manipulation, such as irrigation and fertilization, one must understand the particular disease involved. Practices that may reduce ,the incidence of one disease may well increase the severity of another. In any case, a disease is rarely controlled by environmental or cultural manipulation alone but must be aided by the judicious use of fungicides.

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MANAGEMENT PRACTICES TO MINIMIZE INSECT PROBLEMS*

*Ronald D. Oetting***

Insects are an annual problem in most turfgrass areas. However, it is natural to find many insects and other small arthropods in turf. Only a few of these cause serious damage; some are beneficial; and others may be potential pests that can cause damage if they become too numerous. Many factors affect the presence or absence of pest species. For example, healthy, vigorous turf is less likely to have insect problems and outgrows the effects of many infestations. When turf is in poor condition, damage may be more severe and recovery following treatment slower.

There is quite a complex of pests that damage turf in one way or another. Usually turf pests are divided into two categories: those that feed on the roots and crown below the soil surface and those that feed on plant material above the ground surface. In addition, there are several pests that rest during the day in the thatch and soil and during the night come to the surface to feed on grass stems and blades. As a rule, this group of pests, which includes the Iepidopterous larvae or worms, causes the greatest damage to turf in California. In general, good turf management reduces the severity of damage from all of these pests.

Numerous environmental factors affect the buildup of insect populations in turf and are out of the turfgrass manager's control. These include temperature, location in the turf (such as edge effect), soil type, and rainfall.

Unseasonal temperature changes can increase the chances of new pest problems. For example, an upsurge in frit fly damage is usually associated with extended periods of hot, dry weather. Insects are seldom found randomly distributed in turf. Shady and sunny areas, edge effects, soil condition, slope, and hot spots are common, resulting in high populations in one part of the turf and not in another. These conditions should all be considered when examining for pest damage.

There are also several management practices that both produce a more healthy turf and give severely damaging insect populations less chance to become established:

- New turf. During the establishment period, turfgrasses are vulnerable to attack by insects, especially grubs and other soil pests. A few years ago it was common practice to treat turf areas with chlorinated hydrocarbons before establishment to protect the turf for a long

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period. These persistent compounds are no longer available; now the turf manager must monitor newly planted turf closely for insect damage. It helps to keep the turf fertilized to enhance growth and reduce susceptibility to damage.

- Plant resistance. Varieties of grasses are available that are not as susceptible to insect damage and can tolerate larger populations of pests. However, insect resistance is not one of the major objectives in most turfgrass breeding programs. Degrees of resistance have been observed in experimental programs. Some varieties of St. Augustinegrass are less susceptible to chinch bug damage; some bermudagrasses are less susceptible to bermudagrass mite; and there is a gradient of susceptibility of bluegrasses to sod webworms.

- Over-seeding. In southern California much of the turfgrass is of warm-season species. Warm-season grasses go dormant in the winter, and many managers over-seed with annual grass for green color during the winter. In some instances, over-seeding can increase the chances of insect damage the following year. Bermudagrass over-seeded with a winter grass may be more severely damaged in the spring and summer by the bermudagrass mite.

- Thatch. If thatch is allowed to accumulate and develop a thick layer of organic matter on the soil surface, it can greatly affect insect damage. Initially it provides a haven for insects to hide in, and populations can increase. This is true of most species that spend at least part of the day in the thatch and soil. Also, thatch buildup inhibits insecticide activity. Insecticides cannot get into the soil as efficiently, because they are bound to the organic matter in the thatch. Thatch buildup results in poor water penetration and aeration, which not only weakens the grass but also may make it more susceptible to insect damage. As a result, the turf will not respond to insecticide application, because insecticides are not as effective, and conditions are unfavorable for good regrowth. Although insect damage occurs where thatch is not a factor, many cases of severe damage are associated with a heavy thatch.

- Fertility. Good fertilization programs, especially those utilizing nitrogen, result in less damage from insects such as chinch bugs. The importance of good fertilization programs cannot be overemphasized. Healthy, vigorous turf outgrows the effects of infestations; poor conditions result in more severe damage and slower recovery. Good fertilization programs can result in fewer treatments with insecticides, when they are required.

- Water stress. Turf under stress for water is more susceptible to mite and insect damage, and a much lower population of pests can cause extensive damage. A healthy, well-treated turf can sustain higher populations with no visible damage.

- Weeds. It is good cultural practice to keep turf clean of weeds. Often, insects come to weeds in turf first and then move onto the turf. By eliminating unwanted weeds you can reduce some of your insect problems and have a better looking turf.

These cultural practices, if properly followed, can reduce the damage caused by insects and related arthropods in turf. Cultural practices do not eliminate the need for insecticides or the need to watch for insect damage but, rather, are important in insect control and also in reducing the number of insecticide treatments required.

Almost as important as good cultural practices is recognizing pest populations and diagnosing infestations early, before the turf is heavily damaged. Make routine checks in several locations for pests on the plants and in the soil. Remember that some symptoms characteristic of insect damage may be the result of disease, unfavorable soil conditions, or poor cultural practices, so it must be determined that insects are causing the damage. The presence of lepidopteran larvae or worms can be checked by the pyrethrum test or by flooding. Soil pests, such as grubs and billbugs, can be checked by digging around the roots, by cutting and peeling back a small area of sod, or by taking soil cores.

Even with the best cultural practices, at some time insecticides may be needed to control pest damage. However, cumulative effects of insecticides can be detrimental to pest management. It is important not to use overdosages and needless applications, which can enhance this cumulative effect.

Currently, effective insecticides are available to control turf pests, but every effort should be made to minimize the need for insecticides. Insects that damage turf must be avoided or controlled to maintain a good healthy-looking turf that will be a pride to the owner. Good cultural practices should be the first step in this control.

UC TURF CORNER

Victor A. Gibeault and Forrest Cress*

UC Turf Corner contains summaries of recently reported research results, abstracts of certain conference presentations, and announcements of new turf management publications. The source of each summarv is given for the purpose of further reference.

CULTURAL PRACTICES AID SUMMER DISEASE CONTROL

Cultural practices designed to reduce the activity of pathogenic fungi in turfgrass thatch can help considerably in controlling disease during the summer.

This has been shown in field and laboratory studies of *Helminthosporium* leaf blotch of bermudagrass and *Fusarium* blight of tall fescue at the Texas A&M University Research and Extension Center, Dallas.

Results from this research show that spore production by the fungi that cause these diseases is in creased significantly when clippings in thatch are allowed to dry before being remoistened. A striking release of carbohydrate and protein from dry clippings occurs at each remoistening after drying. This increased release of available nutrients from dried crop debris following remoistening, the Texas researchers believe, plays a major role in allowing the two fungi to produce spores that start disease activity during the summer months.

The researchers suggest basing summer irrigation of turfgrasses on the existing structure of the turf canopy to control *Helminthosporium* leaf blotch of bermudagrass and *Fusarium* blight of tall fescues. The crop debris layer, they say, should be kept moist but not overly wet, because the latter condition would favor activity by other fungal pathogens. A thin-canopy turf should be irrigated more frequently than a turf with a thick or dense canopy. Increasing mowing height during the summer and reducing thickness of the crop debris layer, the Texas researchers suggest, will maintain moisture of the crop debris for a longer period. Localized dry areas of turf also should be detected and corrected as soon as the weather turns hot, they add.

("Cultural Practices Aid Summer Disease Control on Turf," by P. F. Colbaugh, *Proceedings of the Thirty-first Annual Texas Turfgrass Conference,* Texas A&M University and The Texas Turfgrass Association, Dec. 6-8, 1976.)

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