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Snow molds and cold weather diseases

by Christopher Sann

For turfgrass managers, the coming of the cooler weather of fall and early winter signals a time when they can unwind. The fall is a period when they can decompress from the constant state of angst that typifies the turfgrass managers' states of mind during the warm weather months, and forget diseases, weeds and insects until next year. Often managers will spend this time coasting on auto-pilot, sometimes to their regret.

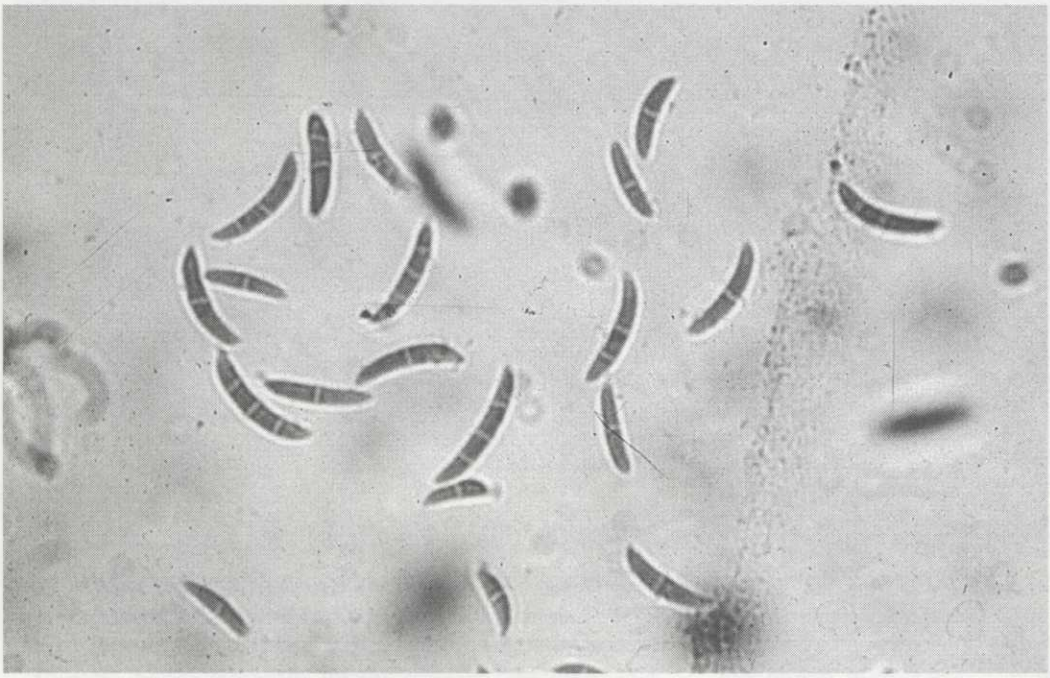


Photo provided by Dr. Eric B. Nelson, Cornell University

Conidia of *Microdochium nivale*. These characteristic 2-celled spores are diagnostic for pink snow mold.

Disease potential at cooler temperatures

The coming of cooler weather does dramatically reduce weed germination and causes the cessation of most insect activity, but it does not eliminate disease pressure. During cool to cold weather periods of the year, with temperatures of from -5 C. to 16 C. (23 - 60 F.), there are no less than 12 well-known diseases or disease groups and 17 lesser-known diseases that can damage turfgrasses.

The well-known cool weather (8 - 16 C.) diseases and disease groups are: *Anthracnose*, Dreschlera diseases, Necrotic ring spot, Powdery mildew, Pythium root rot, Red thread/pink patch, Rust diseases, Rhizoctonia diseases, Smut diseases, and Take-all patch. The well-known cold season diseases are Typhula blight and Microdochium patch. The table (see Table 1 on page 2) lists all of the well-known diseases that affect turfgrass at temperatures below 17 C. (62

IN THIS ISSUE

IN-DEPTH ARTICLES

Snow molds and cold weather diseases 1
by Christopher Sann

Fungicides: an historic perspective 9
by Christopher Sann

INTERACTIONS

Avoiding the trap 10
by Christopher Sann

COMING ATTRACTIONS . 10

ASK THE EXPERT 10

INDEX

Cumulative Turf Grass Trends articles index 12

RESOURCES 15

F.), the causative pathogens, and the pathogens' growth range.

The tendency to ignore this rogue's gallery of turfgrass diseases accelerates as temperatures decline. Once daytime temperatures drop to the forties many turfgrass managers develop a greater interest in warming up, rather than finding, treating, and preventing disease activity. Luckily, with respect to many of the diseases listed in Table 1, their activity is also reduced as temperatures fall. The two exceptions are the cold weather diseases of Typhula blight (Gray snow mold) and Microdochium patch (Fusarium Blight).

Table 1

Disease	**Pathogen**	**Growth range**
Anthracnose	*Colletotrichum graminicola*	10 - 33 C. (50 - 91 F.)
Dreschlera diseases	*Dreschlera spp.*	3 - 27 C. (37 - 80 F.)
Necrotic ring spot	*Leptosphaeria korrae*	10 - 30 C. (50 - 86 F.)
Microdochium patch	*Microdochium nivale*	-6 - 16 C. (21 - 61 F.)
Powdery mildew	*Erysiphe graminis*	15 - 22 C. (59 - 72 F.)
Pythium root rot	*Pythium spp.*	0 - 34 C. (32 - 94 F.)
Red thread	*Laetisaria fuciformis*	0 - 30 C. (32 - 86 F.)
Rust diseases	*Puccinia spp.* *Uromyces spp.*	10 - 30 C. (50 - 86 F.)
Rhizoctonia diseases	*Rhizoctonia spp.*	8 - 40 C. (46 - 104 F.)
Smut diseases	*Ustilago spp.* *Urocystis spp.*	10 - 20 C. (50 - 68 F.)
Take-all patch	*Gaeumannomyces graminis*	N.A.
Typhula blight	*Typhula incarnata*	-10 - 18 C. (14 - 64 F.)

Cold weather diseases can cause extensive damage

Compared to many of the turfgrass diseases that are very active in the warm to hot weather periods of spring and summer, above 16 C. (61 F.), both Typhula blight and Microdochium patch are slow movers. Extensive damage does occur, however, because the cold weather tolerance of both pathogens allows the diseases to spread while host grasses are in dormancy.

Lab tests of Microdochium patch have found that the pathogen shows signs of respiratory activity at temperatures of -30 C. (-22 F.) with some isolates of the pathogen having established the low end of the growth range with minimal growth activity at -6 C.(21 F.). The high end of the growth range is 16 C. (61 F.). Isolates of Typhula blight have established the low end of their growth range with activity at -10 C. (14 F.) and high end with activity at 18 C. (64 F.). This gives the pathogens' growth ranges that span 22 C. (40 F.) and 28 C. (50 C.) respectively. Depending on the region of the country, these temperature ranges can result in periods of activity up to four months long. These extended periods of activity combined with the slow growth or dormancy of host grasses can lead to extensive blighting over large areas of turfgrass.

Typhula blight

Typhula blight, formerly known as gray snow mold, is caused by the pathogen *Typhula incarnata*. This disease was reported in scientific literature as early as 1926 and is probably the best known of the cold weather diseases.

Life cycle

During warm weather, when temperatures are above 18 C. (65 F.), Typhula blight survives as light pink to red-brown colored sclerotia of from 0.2 mm - 5 mm (1/100 - 1/5 inch) in diameter that develop on the crowns and litter of previously diseased turf. These sclerotia germinate when temperatures fall into the 10 C. - 18 C. (50 F. - 64 F.) range, there is abundant water present, and the site is exposed to light high in the ultraviolet part of the spectrum. Depending on the infestation site's light levels, the germinating sclerotia will produce either mycelia or an intermediate growth stage called sporocarps. At sites with either strong direct light or where the sclerotia are buried in thatch or soil, the germinating sclerotia will produce mycelial growth. In areas that are shaded or get diffuse light, they will produce sporocarps. The intermediate growth stage sporocarps will produce basidiospores that in turn will germinate and produce mycelia. If conditions are favorable at the time of sclerotial germination, i.e. extended cool, wet periods, the mycelia that are produced can infect plant shoots causing apparent disease symptoms. More often than not, the conditions needed for extensive disease development are not present when sclerotia germinate, and the mycelia and sporocarps that are produced remain dormant awaiting the proper environmental conditions. Tests of the relative pathogenisity of mycelia produced directly from germinating sclerotia and that formed by germinating basidiospores, have found that the mycelium produced from sclerotia are more potent.

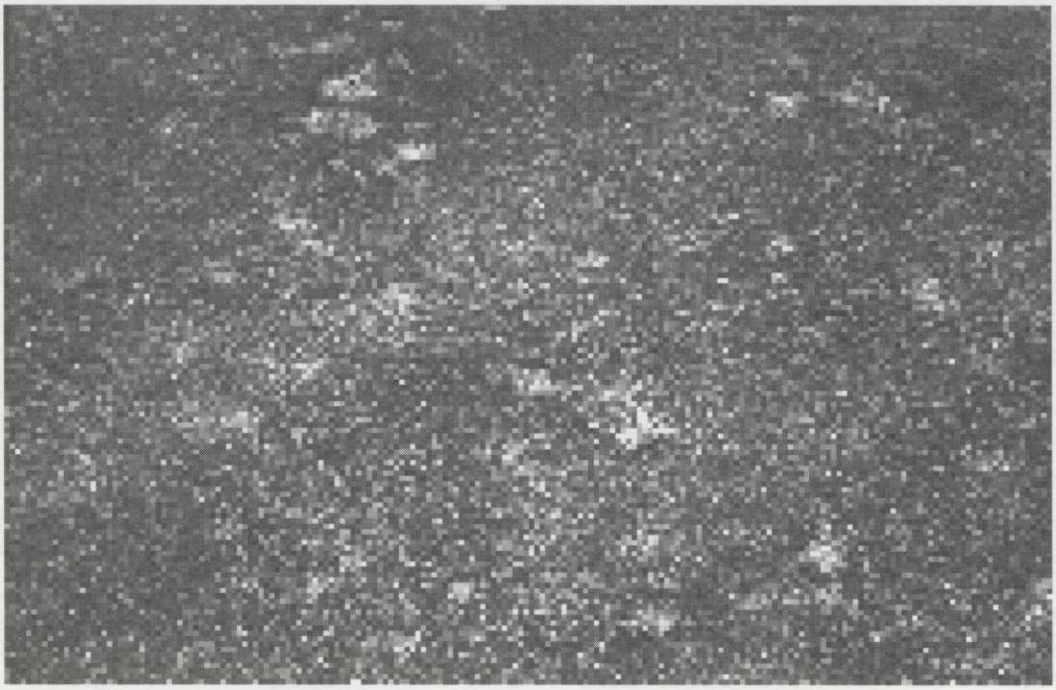


Photo provided by Dr. Eric B. Nelson, Cornell University

Pink snow mold patches may take on an orange to pink appearance on close cut turf.

What conditions are good for Typhula blight?

Typhula blight can cause extensive damage at sites when a prolonged period of snow cover develops on soils that were not frozen at the time of the snow fall or were lightly frozen and warm due to retained heat in the soil mass. Under these conditions, a small air space develops at the soil/snow interface as the retained heat of the soils melts the snow from the bottom up. In this space, the air temperature ranges from 0 C - 5 C. (32 F. - 41 F.) and the relative humidity can reach more than 95%. Optimum mycelial growth for Typhula blight occurs when air temperatures range from 2 C . - 10 C. (35 F. - 50 F.) and when the relative humidity is consistently above 70%. Additionally, tall or uncut turf tends to become matted or overlapped from the initial weight of the snow fall, and the close proximity of one leaf to another facilitates the spread of this slowly growing mycelium.

If the air space environment below the snow cover stays relatively stable for prolonged periods then extensive mycelial masses can develop blighting areas several feet in diameter. If, on the other hand, the snow cover melts or temperatures fluctuate substantially, the growing mycelium will develop sclerotia to survive these short periods of unfavorable conditions. If subsequently the area does not have extended periods of snow cover and air temperatures stay cold, then the further damage that can occur will be insignificant. If snow cover returns for periods of four to six weeks and a new air space develops with a temperature range of 2 C. - 13 C. (35 F. - 55 F.), then the newly developed sclerotia will germinate and cause extensive blighting. Sites that have substantially frozen soil prior to snow cover developing or do not have prolonged periods of snow cover will not develop severe symptoms.

What are Typhula blight symptoms?

Because of *Typhula incarnata's* dependence on snow cover to develop visual symptoms, it is usually first noted at snow melt. Circular areas of light yellow, straw, or grayish brown colored turf become apparent. Under ordinary conditions, these areas can range from three inches in diameter to over six feet under severe circumstances. The leaves in the blighted areas are matted down and are frequently covered with a gray-white mycelial growth, that ranges from sparse to dense in its coverage of the leaves. As the leaf blades dry, they turn light tan to silvery-white in color and the mycelial mat that covers the leaves becomes dry and brittle. Where extensive blighting has occurred under prolonged snow cover, large areas of plants will be killed. When conditions have been less favorable, usually only the leaves are killed and the crowns and roots survive to regenerate new top growth. It is not uncommon for Typhula blight to develop in low areas at sites with higher areas untouched.

As the snow cover melts copious numbers of white to light brown colored, immature sclerotia will often develop on the blighted leaves. The presence of these sclerotia is one of the characteristics that distinguishes Typhula blight from other diseases with similar appearances such as snow scald, with black sclerotia, or Pythium snow blight, with no sclerotia.

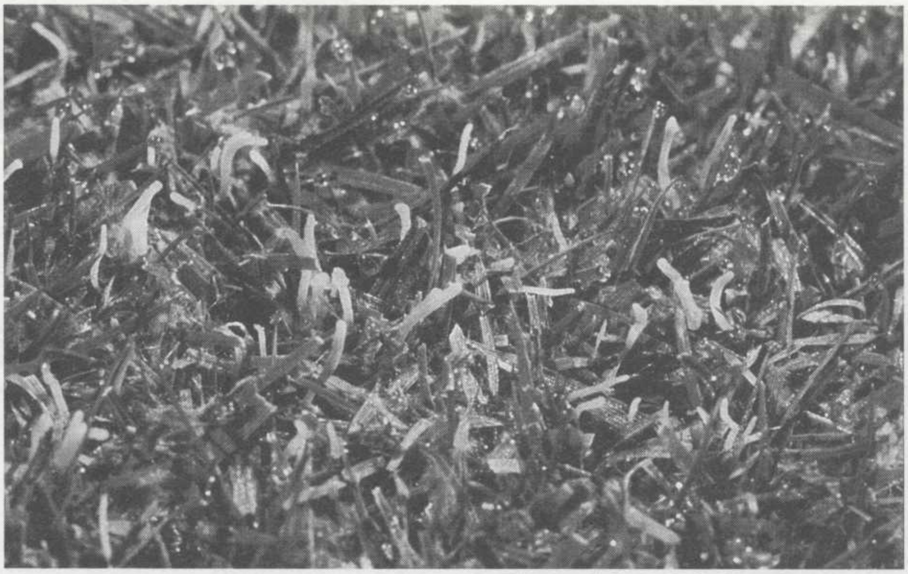


Photo provided by Dr. Eric B. Nelson, Cornell University

Basidiocarps of *Typhula incarnita*. These are the sexual reproduction structures of the fungus that give rise to basidiospores.

Controlling Typhula blight

Since Typhula blight is so weather dependent, control measures can seem somewhat problematical. If the site is in a region of the country that rarely gets prolonged periods of snow cover, then understanding a site's potential for the development of symptoms followed by appropriate cultural practices should prove successful at mitigating most problems with this disease. At sites where snow cover can consistently occur, site analysis and cultural practices should be combined with properly timed preventative fungicide applications to reduce the potential for extensive damage.

First analyze site characteristics

Before either cultural practices are initiated or fungicide applications are made it is important to fully analyze a site for its potential to develop Typhula blight. Identifying hosts, site grades, soil permeability, and light exposures can help to determine whether a site will be vulnerable to damage.

Hosts

All though Typhula blight can occur on all of the common cool season turfgrass species, it is a particular problem on bentgrasses and tall fescue varieties. Within the group of closely cut bentgrass species, the older bentgrasses (particularly the creeping varieties) are the most vulnerable, while the red and brown top varieties are the most resistant. In the tall-cut species, tall fescue varieties seem to be the most vulnerable. [Note: Tall fescue varieties may be more vulnerable because they are consistently mowed at higher levels.] Some varieties of bluegrass, ryegrasses, and fine fescues have shown varying levels of resistance.

Grade

A site that is consistently flat or concave may be vulnerable. If the site has varying topography, then low areas, where water normally flows or sits, may be more vulnerable than higher locations. Areas where snow tends to accumulate will be more vulnerable than areas where snow fall is removed by winds or melts rapidly. Additionally, the disease can develop under mulches or covers that have been designed to reduce winter desiccation.

Photo provided by Dr. Eric B. Nelson, Cornell University

Clamp connections on the hyphae of *Typhula incarnita*. These structures are characteristic of *Basidiomycetes*, the group of fungi with which the Typhula species are classified.

Soils

Soils that are tight, compacted, or have poor structure with reduced pore spaces are vulnerable. Well-drained areas with loose or sandy soils will be less vulnerable to damage.

Photo provided by Dr. Eric B. Nelson, Cornell University

Close up of a pink snow mold patches. The periphery of the patch usually takes on a pinkish appearance, particularly in the morning. This is due to the pink-colored mycelium of *Microdochium nivale*.

Light

Well drained sites that have a consistent light exposure are probably more vulnerable to damage than are other locations which are well drained and shaded or get transient shade. This occurs because the full light areas are more prone to have the more virulent sclerotia developed mycelium than shaded areas that are more likely to have the less virulent basidiospore generated mycelium.

In general, a site that has vulnerable hosts, bentgrasses or tall fescues, is flat or concave, is compacted or has limited soil pore spaces, and is located in full sun areas will tend to have more numerous and more extensive blighting, than a site that is well drained, shaded, of varying grades, and has the less vulnerable bluegrass and fine fescues as the predominant plant populations.

Cultural practices

Once a site has been determined to be vulnerable, those cultural practices that have been identified to ameliorate Typhula blight infestations should be put into place.

Host species that have been identified as showing resistance should be introduced by overseeding at those sites where infestations are only an occasional problem. In areas where extensive damage has previously occurred wholesale renovation with resistant varieties may become necessary. Keep in mind that new stands of all species are more vulnerable than older stands.

Actions to alleviate compaction, change water flow, fill low areas, or correct poor soil chemistry should help vulnerable areas. Additionally, reducing fall fertilization and allowing the turf to become dormant early will improve winter hardiness and thereby reduce vulnerability. If maintaining color is a priority for the site, then the use of slow-release fertilizers or supplemental iron applications should reduce site vulnerability.

Where snow accumulates or is placed, blowing drifting snow piles, periodic removal of piles, or strategic placement of snow fences can be effective at reducing snow cover periods and thereby reduce damage.

How and when should fungicides be used?

Traditionally, applications of fungicides to control Typhula blight have been based on turfgrass managers' best guesses as to when cold temperature plant dormancy will occur, when the first snow fall would occur, or whether the snow that did fall would persist for long periods of time. These methods have their obvious flaws, not the least of which is developing consistent and efficient control.

Where Typhula blight is more than an occasional problem, applications based on weather records and dates have produced better, but still somewhat mixed, results.

The type of fungicide selected and recent site history should determine application timing. If there has been a recent infestation of Typhula blight and the fungicide that has been selected is has a systemic action, then applications of the fungicide should begin as soon as air temperatures are in the 10 C. - 18 C. (50 F. - 64 F.) range. So long as the temperatures are in this range, and depending on the fungicide applied, multiple applications of systemic materials may be necessary.

This approach of protecting the turf during the period of optimum sclerotial germination should prove effective at reducing the pathogen population to the point where appropriately applied cultural practices will substantially lower the potential for extensive damage. In subsequent years, single timely applications of systemic fungicides, or rigorous application of appropriate cultural practices, should make Typhula blight outbreaks few and far between.

If a contact type fungicide is chosen, then the application should be made after the turf has gone into dormancy, but before the first snow fall. In areas with consistent snow cover this application should be delayed until the last possible moment and the rate of active ingredient should be the highest listed on the label. If snow cover is anticipated for short periods and the sites are at times without snow cover, then re-application of contact fungicides should be made to extend the periods of protection.

A strategy that combines rigorous application of cultural practices, site enhancement where practical, and early applications of a systemic fungicide followed by periodic applications of contact type fungicides should provide the turfgrass manager with his best possible defense, even in areas with where extensive damage from Typhula blight is common.

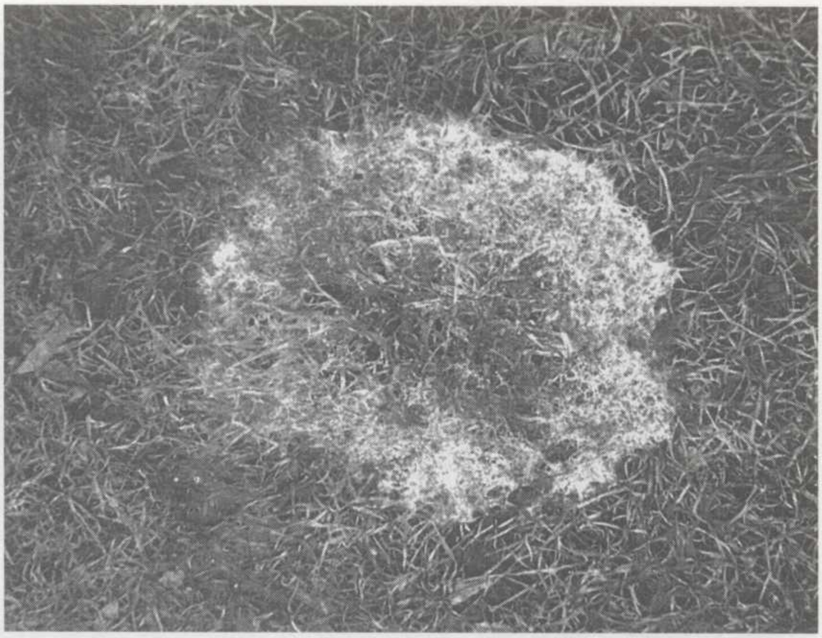


Photo provided by Dr. Eric B. Nelson, Cornell University

Pink snow mold on higher cut perennial ryegrass.

Microdochium patch

Microdochium patch or Pink snow mold as it is more commonly known was formerly known as Fusarium patch disease. Neither of the previous names -- Pink snow mold or Fusarium patch -- are satisfactory descriptive names because the infected turf does not always have a pink color, snow cover is not required for the disease to be present, and identity of the causative pathogen, *Microdochium nivale,* has been changed three times. Despite the fact that the causative pathogen is not a member of the Fusarium species, that name is still used in some locations to describe the symptoms associated with snow melt. The disease was first described in scientific literature in 1933.

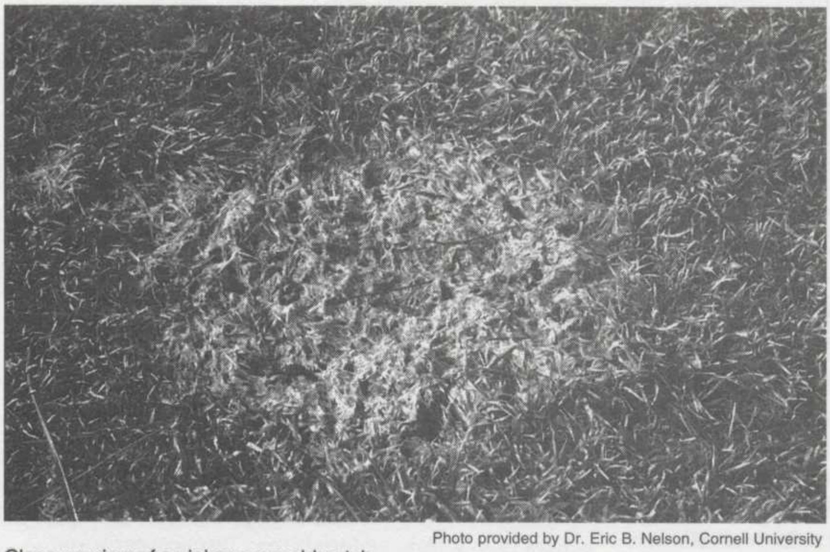


Photo provided by Dr. Eric B. Nelson, Cornell University

Close-up view of a pink snow mold patch.

Life cycle

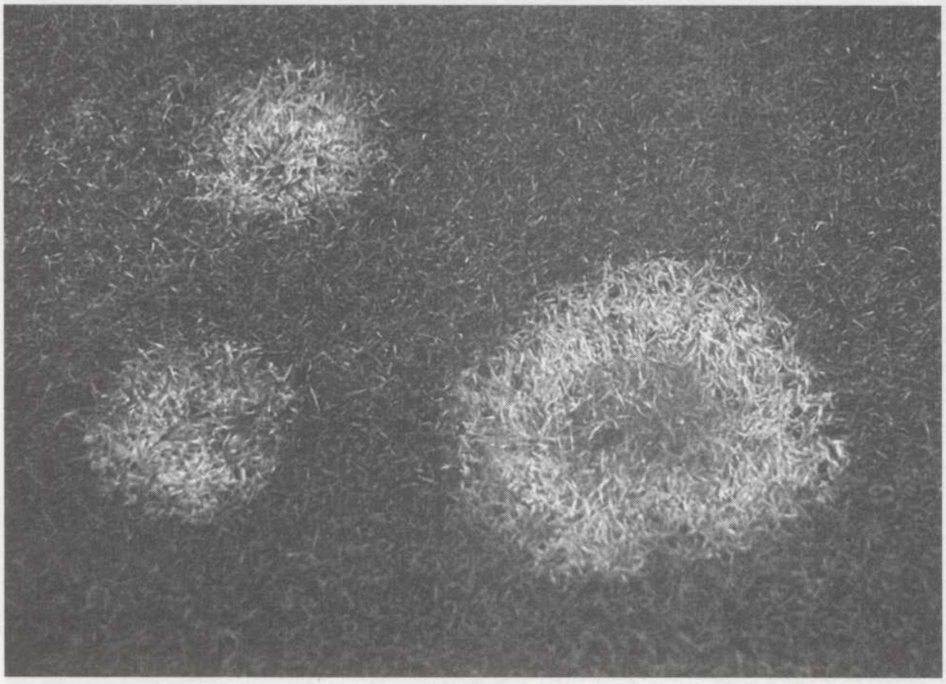
Although the causal pathogen, *Microdochium nivale*, has an optimum growth range of 18 C. - 22 C. (65 F. - 71 F.), this relatively noncompetitive fungus can withstand temperatures as low as -20 C. (-2 F.) and still remained viable. Some isolates of this fungus have shown growth activity at -6 C. (20 F.) on the low end and others have been active at 32 C. (89 F.). Despite this fungus' primary association with periods of cold weather and snow, its active growth temperature spans 38 C. (69 F.). Nevertheless, even though the pathogen is active over a very wide range of temperatures, the symptoms of this disease are most often seen in cool wet weather when grasses are dormant. Since this pathogen favors extended periods of leaf wetness when humidity levels drop and leaf wetness decreases the fungus can become inactive.

During periods when conditions do not favor the growth of this pathogen, it can survive for extended periods as a saprophyte feeding on organic matter in thatch or soil. As more favorable periods of low temperatures and prolonged leaf wetness begin, new mycelial growth is generated from old mycelium or conidia spores in leaf litter. This infection can be spread conidia by wind, the splashing action of rainfall, or through the mechanical movement of conidia or mycelium by equipment, people, or animals.

Conditions that favor the growth of Microdochium patch

Although Microdochium patch can often be found in association with Typhula blight, unlike *Typhula*, prolonged periods of snow cover are not required for this disease to be present. Optimum growth occurs at 0 C. - 8 C. (32 F. - 46 F.) under periods of prolonged leaf wetness where the soil is not frozen.

Also, unlike Typhula blight, Microdochium patch is not usually found at low maintenance turf sites. Conversely, highly managed turf sites with heavy thatch layers are prone to the most severe infestations.



Sclerotia of *Typhula incarnita* embedded in host tissues.

Photo provided by Dr. Eric B. Nelson, Cornell University

Repeated periods of thaw and snow cover, frosts, fog, or drizzle are especially favorable to the leaf to leaf transfer and spread of the mycelium. The disease is active over a wide soil pH range, 4.3 - 7.2, but the higher the pH, the more severe the infestation. Like *Typhula*, the disease favors sites with poorly drained, heavy, or compacted soils.

Applications in the late fall of unbalanced, inorganic high nitrogen fertilizers with little or no phosphorus or potassium predisposes the turf to infection. Low to moderate nitrogen applications improved turf quality better than high or very high levels, which had the opposite effect and increased disease severity. Soils with poor soil chemistry balance, especially low calcium and potassium levels, also showed increased disease activity. Contrary to the application of high nitrogen mineral fertilizers, applications of high potassium and low nitrogen fertilizers, late in the growing season, did not increase disease severity.

Host plant susceptibility varies from species to species. Annual bluegrass is very susceptible to attacks and is often killed. The bentgrasses species, maintained as golf course turf, range from very susceptible to moderately resistant. The bentgrass variety, Penncross, is considered by many to be the most resistant of all the bentgrass varieties. As a group, fine fescues and ryegrasses are considered to be moderately resistant, while most bluegrasses are believed to fall into the resistant category.

What are Microdochium patch symptoms?

Circular patches of infected turf may arise, whenever prolonged cool, wet periods develop. Small water soaked areas less than 2 inches in diameter appear and can rapidly expand into patches 10 - 12 inches in diameter. Initially the patches can have a light to dark brown appearance but this changes to light gray, similar in appearance to Typhula blight. Under wet conditions, a fluffy, white mycelium may be present on the matted leaves of the patch. This is often seen at snow melt. When the mycelium is exposed to light, it changes color to pink. Under wet conditions or on close cut turf, the edges of the patch may appear to have a ring of active fungus similar to the smoke ring of Brown patch.

Turfgrasses that are infected with the cool season form of Microdochium patch are often killed if they are in advanced stages of infection. Often, if the patches are extensive, re-seeding of the large areas becomes necessary.

How to control Microdochium patch

As with Typhula blight, many of the same cultural practices are effective. Cultural practices such as the use of resistant varieties, maintaining good soil chemistry balance, particularly calcium and potassium, improving drainage, and increasing air flow, are the same. Moisture control and pH control differ from *Typhula*, in that excess moisture should be removed from leaf surfaces as soon as possible and the soil surface pH should be kept at or below 6.0. The application of a liquid wetting agent to leaf surfaces may help to reduce leaf wetness periods and light frequent applications of sulfur will discourage the establishment of the disease.

Which fungicides should be used and when should they be applied?

Historically, heavy-metal contact fungicides have been used to control Microdochium patch. For overriding environmental reasons none of the heavy metal materials are still in the turfgrass managers' chemical tool boxes. Additionally, several other contact and systemic materials have been withdrawn by their manufacturers and are no longer available.

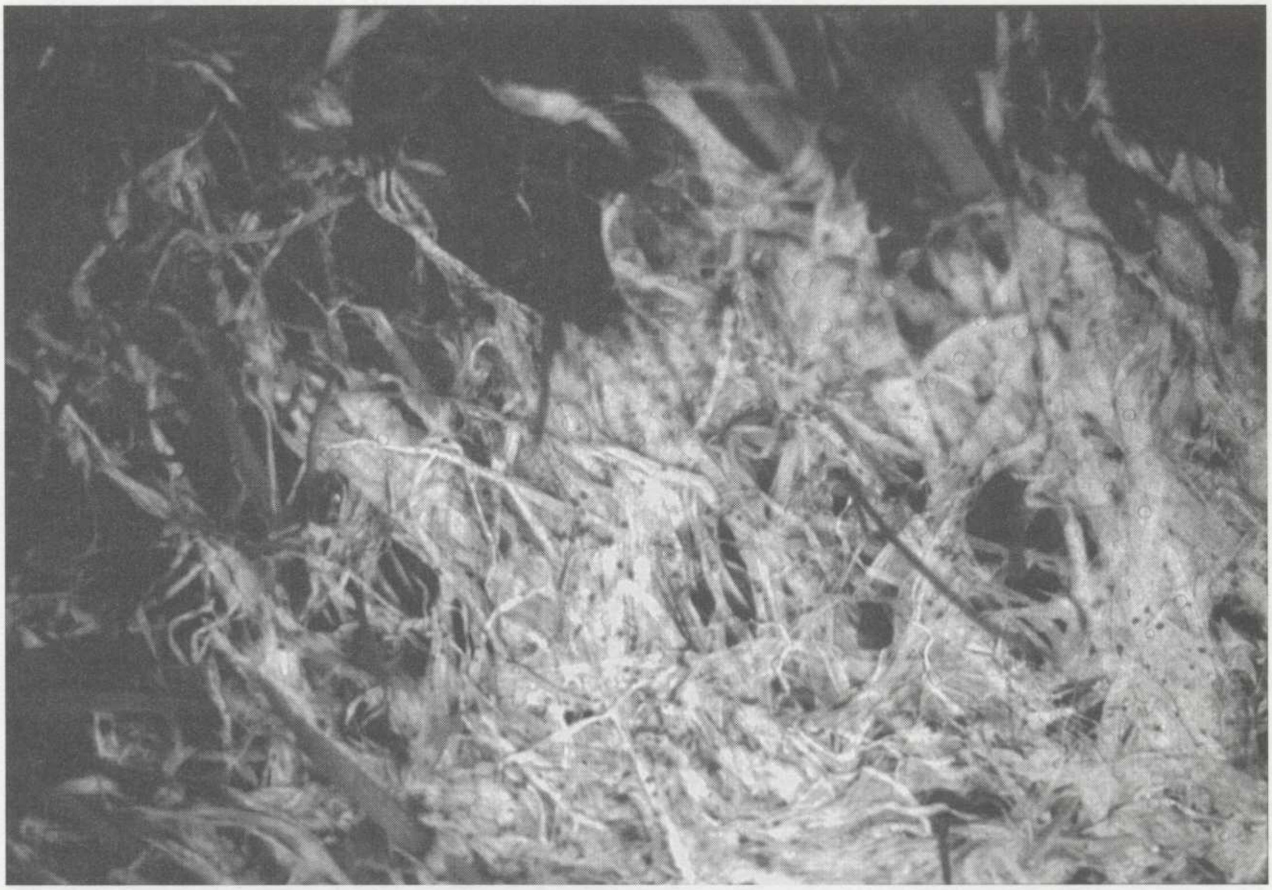


Photo provided by Dr. Eric B. Nelson, Cornell University

Close-up of Typhula blight patch. Small brown to reddish-brown sclerotia are visible in the interior of the patch.

The number of fungicides that can be used on turf to control this disease is down to a handful, so turfgrass managers should be careful to check their labels to be sure that the fungicide that they have chosen is still registered for this use. In contacts, PCNB and iprodione can be effective while in systemics the newer sterol inhibitors have proven to be effective.

If a systemic fungicide is chosen, then an application should be made after daytime temperatures fall below 10 C. (50 F.), but at least 15 to 30 days before the onset of cold dormancy or snow fall. If a liquid contact fungicide is chosen, the application should be made to dry leaves after the onset of cold dormancy and as close to snow fall as possible. Additional contact applications can be made during snow free winter periods, if infestation levels warrant and daytime air temperatures are high enough for a liquid application. Granular applications can be made at these times, if leaves are wet and the site is stable enough to support equipment travel.

In severe cases of infestation, these two strategies, systemic fungicides early and contact fungicides late, can be combined with rigorous application of cultural practices to produce maximum effectiveness. Whichever strategy is chosen for Microdochium patch control, the fungicides that applied should be rotated with each application because of the limited supply of chemical tools that are available and to avoid the development of resistant pathogen populations.

Start with an inventory

The key to any cold weather disease control strategy is allowing time for a complete turf site inventory by disease potential. Done early enough, this inventory should identify all sites which are predisposed to cold weather diseases while there is still time to implement corrective and preventitive actions. Steps might include site changes, introduction of appropriate cultural practices, or developing a plan for chemical application. Following this strategy every year should keep cold weather diseases in permanent check. ■

Fungicides: an historic perspective

by Christopher Sann

Turfgrass managers at highly maintained sites, such as golf courses, large commercial proper ties, sports facilities, as well as lawn care operators, consider fungicides to be an indispensable tool in their strategy to improve and maintain turf. The number and variety of these essential control materials provides the modern turfgrass manager with a full pallette of tools that when properly used can solve a specific problem, while subjecting the environment and those who populate it to little danger. The information system that surrounds the use of modern fungicides and their ease of use allows turfgrass managers to make and carry out disease control decisions with an unprecedented level of confidence.

The concept of fungicides is not new

From an historic perspective, modern, tightly focused, consistently effective fungicides are a very recent development despite the fact that man's first attempts to control diseases on plants go back centuries.

Early attempts at fungus control can be dated as far back as 800 BC, when Homer, the Greek poet wrote about the use of sulfur to control disease in both of his epic poems, the Iliad and the Odyssey. Roman literature makes note of rust infestations in cereal crops and how the Romans held the annual feast of Robogalia to appease the rust gods.

The first recorded use of a seed protectant fungicide was 1761, when copper sulfate was used to control the disease of bunt in grains. The first foliar fungicide, lime sulfur, was used in 1802 to control powdery mildew on fruit trees.

100 years ago: the first prepared fungicide

The first prepared fungicide is generally considered to have been Bordeaux mix. It was discovered in 1882 when a Frenchman, named Millardet, observed that grape vines that had been spattered with a mixture of lime and copper sulfate were free of down mildew. Within three years, through experimentation, he had worked out the classic 3:1:100 mixture ratio of copper sulfate to calcium oxide to water that is still used today.

1931: the first manufactured fungicide

The first patented, manufactured fungicide, Thiram, was developed by DuPont in 1931. In 1932, the first soil fumigant was recognized when the use of chloropicrin (tear gas) resulted in dramatically increased agricultural yields. In 1945, Dow introduced ethylene dibromide as a soil fumigant. Vapam, another soil sterilent, was introduced by Stauffer in 1954.

In 1940, Rohm & Haas developed the dithiocarbamate, EBDC, and its use in field studies in 1941 lead to the issuing of a patent on nabam in 1943. Work on nabam, to reduce some of its undesirable side effects and its weaknesses in control, lead to the introduction of a zinc-based formulation of dithiocarbamate called Zineb in 1948. In 1949, Captan was developed at Rutgers University. Further work on dithiocarbamate fungicides lead to the manganese based formulation, Maneb, and then ultimately to the current reformulation which combines Maneb with zinc and manganese which was introduced as Mancozeb in 1962.

1960s: modern fungicides

Modern fungicides first appeared with the introduction of chlorothlonil in 1964 by Diamond Alkali. This was followed by the release of benomyl in 1968 from DuPont and thiophanate methyl by Nippon Soda in 1969.

In 1975, feneramol and triadimefon, two of the very popular sterol inhibitor fungicides were developed, as was propiconizole in 1979.

At around the same time, the two *Pythium* active fungicides, metalaxyl and fosetyl-al, were discovered in 1977.

More and different fungicides are coming

The near future will see several new and different materials become available. There are already EPA registrations for newly discovered or reformulated fungicides scheduled in the coming years, many in the sterol inhibitor class.

ICI expects to offer the first mitochondrial respiration inhibitor, a bio-rational fungicide, by the turn of the century. This introduction will represent a dramatic shift in emphasis and may ultimately produce a class of materials that provide precise fungus control with virtually no adverse environmental impact. ■

Avoiding the trap

by Christopher Sann

It is funny how events, which at the time they occur seem insignificant, can later become quite important. Several incidents during recent weeks have brought this truism home to me with considerable impact.

In early August, for the second time in two years, I spent three days at the Superintendents Diagnostic Short Course at Cornell University in Ithaca, New York. My primary reason for going was to initiate a very promising new employee, Brett, into the world of turfgrass management the right way -- dealing with and getting to know turfgrass management from a top-notch program. As it turned out, even after 20 years in the industry, I got as much from the course as my new employee did.

Although a little overwhelmed by all the new information, Brett was exposed to one of the top programs in the industry and, if nothing else, he came away from the conference with a healthy respect for the need to be scientifically accurate as a turfgrass manager.

My continuing education involved field diagnosis. After several incorrect diagnoses on my part, I concluded that even the most experienced turf grass management professional requires regular exposure to various turf diseases in order to maintain a current knowledgebase for making those same judgments in the field.

A friendly battle with Nelson

Dr. Eric Nelson, a participant at the conference, and I have had a friendly running battle for the past four years. Nelson contends that it is impossible to make an accurate diagnosis of turfgrass problems from visual symptoms while standing six feet away. Smug with the belief that real-world field experience is better than book experience, I have contended that an experienced, observant turfgrass diagnostician should be able to use gross visual symptoms to make an accurate diagnosis the majority of the time.

Nelson's point of view has been honed over many years by microscopic diagnosis of pathogens on multiple turfgrass species under all kinds of environmental circumstances. My point of view was based on over 20 years of field experience, primarily with high-maintenance, tall-cut turf situations.

Nelson was right

The events of the past two weeks have driven home the idea that trying to make visual diagnoses in the field without a follow-up close examination of a sample with a strong hand lens or microscope is a trap. These last two weeks have proven to me that I have been wrong and Nelson has been right.

During that period, I have had to explain to a disappointed long-time lawn care client why my annual July applications of grub control last year did not prevent major grub damage to his lawn starting in May of this year. I had to figure out why 25% of another client's lawn died from Bipolaris leaf spot, even though it was being treated for just such an infestation. I also suffered the embarrassment of having to admit to a third client that, though I had previously assured him that I understood what was going on, I had been unable to solve the riddle of why his front lawn would only hold good color for two weeks after a fertilization.

A common mistake

In all three instances I made the mistake of assuming that I could correctly diagnose the problems from visual symptoms alone, without a proper confirming examination. In all three instances, after considerable damage to my over-inflated ego, I went back and did a complete examination of the problems. I now know the real causes.

In the first instance, a close examination of the anal slits and anal hair patterns of some sample grubs produced the conclusion that we were not dealing with second or third Japanese beetle grubs instars -- those that the July insecticide application was intended to control -- but we were dealing with a second year/third instar infestation of Oriental beetle grubs that had been actively feeding since mid-May.

In the second problem, lawn had been treated for Summer leaf spot (*Bipolaris*) in early July, but had developed substantial damage which had an appearance of a blight that often develops when this pathogen gets into the crowns of the host plants. A close examination, however, revealed that the damage was caused by frit fly maggots tunneling down through the plant shoots. This misdiagnosed infestation may have existed for four or five years.

In the third problem, the lawn historically looks good in the spring and fall, but fails to hold color from fertilizer applications during warm weather even though the soil chemistry is in excellent shape and the turf is being treated for chronic Necrotic ring spot and Pythium infestations. Last year, in an effort to understand what was happening, I had made the correct visual diagnosis of a Bipolaris infection, but then failed to make the more important diagnosis of a heavy Anthracnose infestation, which turned the turf stand yellow. When I did a more thorough job of examining the current grab samples, the characteristic Anthracnose spores were obvious. As is often the case, the fungicide that I had used to control the Bipolaris was not effective against the Anthracnose infection.

These mistakes can cost dearly

Luckily, I will not lose these homeowners as future clients, but it will cost me about $500 to repair the damage caused by my over-inflated ego.

If these problems had occurred at a golf course with damage to several greens, the cost to repair could have run into the thousands of dollars and perhaps left me seeking alternative employment.

Why did I miss these three problems

In looking back at these three problems for a common thread, I came to the conclusion that my failures were principally in two areas. The first was a failure to closely examine what was happening because of the amount of time it would have taken. I fell into an easy trap by accepting the most obvious possible solution. The second failure occurred because I was afraid that my previous diagnosis was inaccurate, or that if it was indeed accurate that I had failed to make a corrective action in time to control the problem. In other words, I was trusting my instincts when I should have been examining the problems scientifically.

If you find that you are failing your clients or more importantly that you are failing yourself, then it is time step back and find out why you are failing. Perhaps you too are relying more on instinct and less on scientific examination. That is a problem faced by many turf grass managers who believe they have already "seen it all." In other words, turf grass management remains a science and not an art so we must abide by the rules of science when forming conclusions or diagnosis.

In the near future, as common pesticides become even more regulated as to the circumstances allowing proper usage, this kind of seat-of-the-pants diagnosis with sloppy procedure may get you more than an unhappy customer, an angry greens committee chairman, or a feeling of embarrassment and disappointment. You might even find yourself answering to a state or federal regulatory agency. ■

Coming attractions

November Issue

Biological soil management

Subject index of back issues, Part 1

ASK THE EXPERT

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Articles index of all back issues

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A

Adjusting management and cultural practices to improve control of Summer Patch
Sann, Christopher, June 1992: 6—11
Alligators all around
McKinney, Russ, November 1993: 13—14
Alternative strategies for controlling chinch bugs
Sann, Christopher, May 1994: 6—7
Annual bluegrass: its biology and control
Neal, Joseph C., April 1994: 13—14
Are drift control agents coming to turf?, Premier 1992: 13

B

Before you begin: Course preparation
Bator, Richard, June 1994: 10—12
Benefits of reducing thatch in bluegrass turf, June 1992: 15
The big unstated issue
Sann, Christopher, Premier 1992: 11, Premier 1992: 13
Bill would tax pesticides and fertilizers, December 1993: 14
Billbug biology and susceptible varieties, July 1992: 10
Biological controls: Promising new tools for disease management
Nelson, Eric B., January 1994: 1—4, January 1994: 7—9
Biological controls are tricky, Premier 1992: 13
Biotechnology: The future of the turfgrass industry, June 1992: 14—15
Brown patch - a different perspective
Sann, Christopher, June 1994: 8—9, June 1994: 15

C

California study: Oxadiazon enhances buffalo grass establishment, March 1994: 13
Canadian study shows benefit of using balanced fertilizers, Sept/Oct 1992: 12
A change of season
Haber, Juergen, June 1994: 13
Chinch bugs, a refresher course
Sann, Christopher, May 1994: 1—5, May 1994: 12
Confusion reigns: Naming cool- and warm-season Pythium diseases
Nelson, Eric B., July 1994: 8—9
Consider options when replacing spray tips, Premier 1992: 9
Cornell University study compares clippings yields: Low maintenance turf growth rates compared, March 1994: 12
Court rules against OSHA, Sept/Oct 1992: 10
Cultural controls: How to minimize leaf spot and melting out damage
Nelson, Eric B., April 1994: 7—9
Curing disease is one thing, but changing hearts and minds is another
Sann, Christopher, January 1994: 15
Cutting height impacts soil temperature, June 1992: 15

D

Dear reader: Turf Grass Trends is back — to stay
Haber, Juergen, November 1993: 13
Dethatching anc chinchbug, July 1992: 10
Diagnosing leaf and root diseases
Sann, Christopher, November 1993: 15
The diagnostic art
Sann, Christopher, June 1992: 12—13
The disease triangle and the disease cycle
Nelson, Eric B., August 1994: 8—9
The dog days of August: Seeing grubs and Pythium in a new light
Haber, Juergen, August 1994: 15
Dreschlera and Pyrenophora: leaf-spotting diseases
Nelson, Eric B., April 1994: 1—6, April 1994: 11
Dry encapsulation benefits workers and plants, Premier 1992: 13
DuPont wins fifth of nine Benlate lawsuits, February 1994: 12

E

Earthworms, July 1992: 10
Effective management of Japanese beetles
Villani, Michael G., July 1992: 1—3
Endophytes don't aid drought tolerance, January 1994: 14
Entotech/Mycogen lawsuit settled, Sept/Oct 1992: 10
Environmental Laws, Agencies, and Terms, December 1993: 3, December 1993: 9, December 1993: 10—12, December 1993: 15
Environmental leadership is an opportunity
Nelson, Eric B., March 1994: 14—15
Environmental regulations: Lean and mean 80s give way to clean and mean 90s
McKinney, Russ, December 1993: 1—5, December 1993: 8
Environmental regulations and related trends: Who's affected and how?, December 1993: 13
E.P.A. & Texas college offer hotline, August 1992: 11
E.P.A. files suit against Miles, August 1992: 11
E.P.A. will investigate granular pesticides danger to birds, August 1992: 11
EPA failures: Standards delayed, August 1994: 14
EPA to place emphasis on enforcement, August 1994: 13
An examination of the 2,4-D issue: Is there fire where there is smoke?
Sann, Christopher, March 1994: 8—11, March 1994: 15
Expo Fever: TGT at the GIE
Haber, Juergen, February 1994: 15

F

Fed issued "final" rules on training for workers who transport hazardous materials, July 1992: 9
Federal legislation tops summer regulatory agenda, June 1992: 13
Feds crackdown on "haphazardous" waste reporting, Premier 1992: 11
Florida study: No link between fertilization and chinch bug

Articles index of all back issues

activity, May 1994: 12
Focus on turf roots or leaves?, Premier 1992: 9
Forget the tea leaves, read soil cores instead, Nov/Dec 1992: 9—10
Future trends in turfgrass research
Nelson, Eric B., February 1994: 9, February 1994: 14
The future of the business of turfgrass business
Sann, Christopher, February 1994: 10—11

G

Grub control: Old standbys and new directions
Sann, Christopher, July 1992: 4—7

H

Hawaiian study: Genetics plays role in insecticide resistance, May 1994: 13
Hazardous waste water generator, July 1992: 9
Herbicide, pesticide bills up in Congress in 1994, March 1994: 6—7
High endophyte levels in tall fescue does not deter grub feeding, May 1994: 15
High maintenance impact on fine fescues, July 1992: 10
How to improve short-term drought stress tolerance
Sann, Christopher, August 1992: 7—11
How to use National Turfgrass Evaluation Program results
Morris, Kevin, Sept/Oct 1992: 1—8
Hysteria
McKinney, Russ, July 1992: 11

I

Identifying the factors: Predicting grub damage in turf
Villani, Michael, August 1994: 1—6
Illinois study: Dormant fertilization shows higher rates of nitrogen produce best results, February 1994: 13
Industry group issues new standardized MSDS format, July 1992: 9
Integrated pest management: Definition suggested, August 1994: 14
Integrated pest management is the future
Sann, Christopher, August 1994: 6—7
Iowa College of Medicine: Health effects of farming on farmers, May 1994: 14
Is *Pythium* really a fungus?
Nelson, Eric B., August 1994: 11, August 1994: 15
Israeli's works on genetic approach to nitrogen uptake, Sept/Oct 1992: 12

K

Keys to good soil chemistry: pH and nutrient ions
Sann, Christopher, Nov/Dec 1992: 1, Nov/Dec 1992: 3—6
Killer proteins identified, Premier 1992: 13

L

Landscaping has average home improvement value, January 1994: 14
Laser guided fertilizers?, July 1992: 10
Late summer leaf spots and leaf blights
Nelson, Eric B., August 1992: 1—6, August 1992: 11
Liming and fertilizing, Premier 1992: 9
Lower risks of herbicide exposure, Premier 1992: 9

M

Making the most of our opportunities
Sann, Christopher, August 1994: 10, August 1994: 15
Massachusetts charters a different course on recertification, January 1994: 13
Michigan State study: Aeration, rototilling before planting improves rooting, February 1994: 12
Michigan State Study: Threshold levels of anthracnose spores identified, June 1994: 14
Midwest flood recovery underway, but will take years
Parks, Jim, November 1993: 10—12
Milky spore disease may not be an effective biological control for grubs, May 1994: 13
More states pass pre-emption bills, December 1993: 15
More than meets the eye: The microbiology of turfgrass soils
Nelson, Eric B., February 1994: 1—7, February 1994: 14

N

New federal legislation: Would curtail pesticides even more, August 1994: 14
New off-road diesel standard proposed, December 1993: 14
New regulations cover storm water run-off, Premier 1992: 11
New software: SimCity to SimFarm, March 1994: 12
New water pollution act introduced, December 1993: 14
New wetlands policy proposed, December 1993: 14
New Zealand study: Greens establishment shows dramatic loss of water infiltration rates, February 1994: 13
Nitrogen volatilization studied, January 1994: 14
Notes on 2,4-D studies
Sann, Christopher, March 1994: 8—9
Notification act redrafted, August 1992: 11

O

Ohio puts labeling of possible carcinogens on the ballot, July 1992: 9
Ohio State University study: Shredded paper mulch better than wheat straw, March 1994: 12
Oregon fines Great Western for mislabeling seeds, August 1992: 11
...others feed on pesticide residues, Sept/Oct 1992: 12
An overview: Pythium diseases of turfgrasses
Nelson, Eric B., July 1994: 1—7
Ozone alert ban on landscape equipment proposed in DC

P

Patch disease co-factors: A host of unrecognized, contributing factors
Sann, Christopher, Premier 1992: 6—8
Pesticidal bacteria can be programmed to self-destruct, Sept/Oct 1992: 12
Pesticide theft increases in California—and elsewhere?, Sept/Oct 1992: 12
Poa to bentgrass: A successful fairway conversion program
Bator, Richard, June 1994: 10—13

Article index of all back issues

Politics, turfgrass management, and the future
Sann, Christopher, April 1994: 12, April 1994: 15
Posting: It's a matter of courtesy
Sann, Christopher, July 1992: 8—9
Potassium's value confirmed, Premier 1992: 9
Process is the key to disease-suppressive composts, January 1994: 4—6
Product labels are no substitute for MSDS's in California, July 1992: 9
Pythium root rot: A growing problem on high maintenance turf
Nelson, Eric B., Premier 1992: 1—4

R

Recording hazardous waste water, July 1992: 8
Recording use of pesticides, Premier 1992: 10
Reducing necrotic ring spot damage
Sann, Christopher, November 1993: 5
Report from Iowa State University: Slow release frtilizers increase root mass, February 1994: 12
Report from New Zealand: Soil permeability and deep cultivation techniques, February 1994: 12
Report will impact the turf industry, December 1993: 14
Results of Clean Water Act debated, January 1994: 14
Rhizoctonia diseases: Brown patch and its cousins
Sann, Christopher, June 1994: 1—7

S

Scouting for chinch bugs
Sann, Christopher, May 1994: 8—9
Scouting weeds takes methodical approach, March 1994: 4—5
Soil: A biological resource worth managing
Nelson, Eric B., Sept/Oct 1992: 11
Soil: What is it anyway?
Nelson, Eric B., Nov/Dec 1992: 11—12
The state of turfgrass research
Nelson, Eric B., Premier 1992: 12
Study links soil moisture, fertility, and leaf production, Sept/Oct 1992: 12
A successful fairway conversion program
Bator, Richard, July 1994: 10—15
Summer Patch: The biology and conditions that favor its growth
Nelson, Eric B., June 1992: 1—5

T

Taking soil samples, Nov/Dec 1992: 2
Texas A & M study: Air, canopy and soil temperature relationships, June 1994: 7
Trends in violations: Who did what and where?, December 1993: 6—7
Trucking regulations may apply to turfgrass managers, August 1994: 12
Turf diagnostic tools—temperature
Sann, Christopher, November 1993: 8—9
Turf events in New York, June 1992: 14
Turfgrass management in 2004, February 1994: 8, February 1994: 11

U

Understanding fungicides, Premier 1992: 5
Understanding necrotic ring spot
Sann, Christopher, November 1993: 1—4, November 1993: 6—7, November 1993: 15
Understanding soil test reports
Sann, Christopher, Nov/Dec 1992: 7—8
University of Florida study: Dithiopyr granules superior to liquid, April 1994: 15
University of Georgia Research: Bermuda grass can be controlled in tall fescue, May 1994: 14
University of Illinois study: More weeds mean lower crop yields, August 1994: 14
University of Maryland study: Pre-emergent herbicides work the following summer, March 1994: 13
University of of Georgia study: Bad effects of soil compaction on turfgrass, February 1994: 2
University of Rhode Island study: Tall fescues are more efficient at leaf growth, February 1994: 14
Using IPM to manage weeds in turfgrass
Neal, Joseph C., March 1994: 1—3, March 1994: 6—7

V

Volatility seen as factor in applying pesticides, Premier 1992: 10

W

A welcome to our new subscribers
Haber, Juergen, May 1994: 11
Well water survey continues, Premier 1992: 11
What will biologicals do for turfgrass management?
Sann, Christopher, January 1994: 10—13
What's it like to be inspected, December 1993: 4
Why do the names of fungi change? A taxonomic history of Dreschlera and Pyrenophora
Nelson, Eric B., April 1994: 10—11
Why granular Triumph isn't available, Sept/Oct 1992: 10
Why lime turf?, Premier 1992: 9
Why using NTEP reports is worth the effort, Sept/Oct 1992: 9—10
Wind, application drift and the applicator
Sann, Christopher, May 1994: 10—11
Workers & schedules
Bator, Richard, July 1994: 13, July 1994: 15
A worthy challenge
McKinney, Russ, Premier 1992: 14—15

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