TURF DISEASE GUIDE

Two leading plant pathologists, J.M. Vargas Jr. of Michigan State University and Don Blasingame of Mississippi State University, cut through confusing terminology and present the latest turf disease control methods. Diseases of cool-season turfgrasses, warm-season turfgrasses, and overseeded ryegrasses are discussed. This is a section you'll want to save. An aded help is the Turf Fungicide Directory on page 44.

Northern Turf Diseases

by **J. M. Vargas, Jr.**, turfgrass pathologist, Michigan State University

Concepts about turfgrass diseases and their management have gone through many changes in the past few years, including the scientific names of the organisms that cause them.

These diseases, the organisms that cause them, and their cultural, biological and chemical management tools are given in Table 1. The following will be a discussion of the latest developments on cool-season turfgrass diseases.

Dollar spot

Dollar spot is primarily a disease of golf course grasses such as creeping bentgrass and annual bluegrass. It is now believed to be caused by two organisms, a *Lanzia* spp. and a *Moellerodiscus* spp.

Now that two fungi have been identified as the cause of dollar spot, it helps explain some of the confusion that has existed about the occurrance of this disease. It has been considered both a cool weather disease and a warm weather disease. It appears that dollar spot is both, and that there are two different fungi which caused a disease with similar symptoms. This means that you can have dollar spot at any temperature between 60-85° F.

What is needed is an easy, reliable method to distinguish the difference between these two fungi in the field. Fortunately, dollar spot caused by both fungi appears to be reduced by adequate nitrogen levels and adequate soil moisture levels. For the most part, they are also managed by the same fungicides, although one has to wonder if some of the resistance to some fungicides might not be due to the differential sensitivity of the two fungi species that causes this disease.

Brown patch

Brown patch is also primarily a disease of golf courses, although with the new improved perennial ryegrasses being incorporated into home lawn mixtures, it is also becoming a problem on home lawns.

The disease occurs under hot, humid conditions. It can be culturally managed by reducing the amount of nitrogen applied just prior to the advent of warm weather, increasing air circulation by removing trees or shrubs, and/or by pruning them.

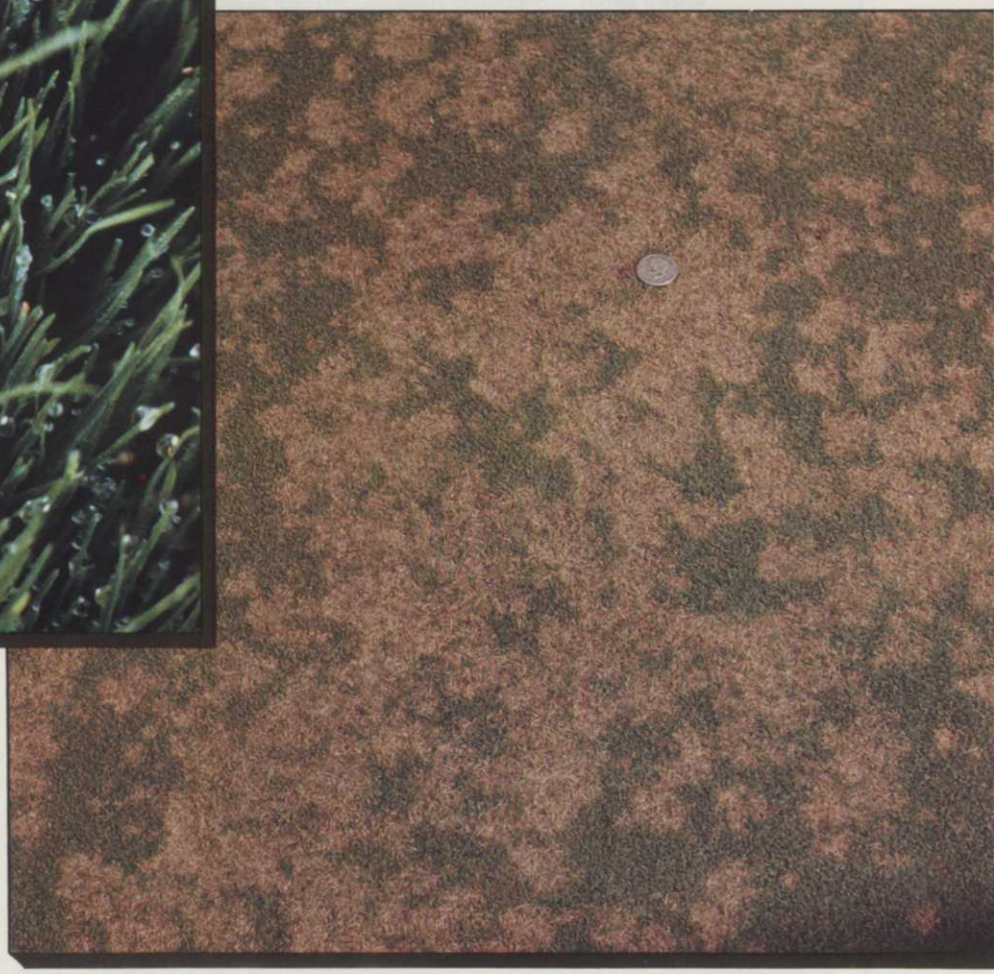
Pythium blight

Pythium blight is also a disease of golf courses, and like brown patch, it is becoming more of a home lawn problem with the incorporation of the improved perennial ryegrass.

There still seems to be some controversy over how many species of pythium are involved in this disease, but regardless of how many or how few there are, they do tend to cause rapid loss of turf in hot, humid weather.

Unlike many diseases where only the foliage is damaged and recovery occurs soon after, Pythium blight usually kills the plant. This means recovery in the infected areas will be slow because it will have to come from

Pythium blight *rapidly strikes ryegrasses and other turfs where drainage is poor in hot and humid weather. Recovery is slow since pythium usually kills the entire plant.*



Dollar spot *damages bentgrass, annual and perennial bluegrass, bermudagrass and zoysiagrass. In the South it is common in the spring and fall. In the north it is active anytime temperatures are between 60 and 85°.*

rhizomes or stolons filling in from outside the spots or by germination of annual bluegrass or broadleaf weeds when the cool weather of the fall returns.

Cultural management of Pythium blight consists of reduced nitrogen levels just prior to the advent of warm weather and improving drainage.

Concerning drainage, in marginal areas of the cool-season grass regions, Pythium blight is only a problem in areas of poor soil drainage, where water stands for prolonged periods. In regions where severe Pythium blight damage occurs, it is always most severe in poor drained soil areas. It goes without saying, that good Pythium blight management begins with improving soil drainage.

As far as chemical management is concerned, there are two systemic fungicides to manage Pythium blight, which are metalaxyl (Subdue, Ridomil, Apron) and propamocarb hydrochloride (Banol). These two fungicides will manage the disease for up to three weeks. They appear to be slower acting than chloroneb (Teremec SP) or ethazol (Koban, Terrazole). Little spread of the disease occurs after these systemic fungicides are applied, although the mycelium of the fungus may remain evident on the previously infected tissue for a couple of days. No actual resistance to these two fungicides has been reported, but the possibility exists. It would be wise therefore, to follow each systemic fungicide application with contact (chloroneb or ethazol) in case resistance does occur following a systemic fungicide application, the contact fungicide will prevent the resistant strain from devestating the turf.

Anthracnose

Anthracnose caused by *Colletotrichum graminicola* is primarily a disease of annual bluegrass, although it will attack the fine leaf fescues, perennial ryegrasses and seaside creeping bentgrass.

Annual bluegrass dies from an-

TURF

Table 1: TURF DISEASES AND CONTROLS*

Disease	Causal Agent	Hosts	Cultural Control	Chemical Control
Anthracnose	*Collectotrichum graminicola*	Annual bluegrass Fine-leaf fescue Kentucky bluegrass Perennial ryegrass	Adequate nitrogen. Cool grass by syringing	Maneb plus zinc sulfate, chlorothalonil, benomyl, thiophanate-methyl, thiophanate, thiophanate-methyl + mancozeb, triadimefon
Brown patch	*Rhizoctonia solani*	All major turfgrass species	Reduce nitrogen. Remove "dew." Increase air movement.	Mancozeb, maneb + zinc sulfate, chlorothalonil, anilazine, cycloheximide + thiram, benomyl, thiophanate-methyl, thiophanate, thiram, thiophanate-methyl + maneb, cadmium compounds, thiophanate + thiram, PCNB, iprodione, vinclozolin
Dollar spot	*Lanzia spp.* *Moellerodiscus spp.*	Annual bluegrass Bahiagrass Bermudagrass Centipedegrass Colonial bentgrass Creeping bentgrass Fine-leaf fescues Kentucky bluegrass Perennial ryegrass St. Augustinegrass Zoysiagrass	Increase nitrogen. Remove "dew".	Benomyl, thiophanate, thiophanate-methyl, chlorothalonil, anilazine, cycloheximide + PCNB, cadmium compounds, thiophanate + thiram, thiram, thiabendazole, benomyl, iprodione, thiophanate-methyl + maneb, vinclozolin, triadimefon
Fusarium blight syndrome		Kentucky bluegrass Centipedegrass	Light, daily watering during the summer.	thiophanate-methyl, thiophanate, triadimefon
Helminthosporium Diseases	*(Dreschlera)*			
Brown blight	*D. siccans*	Ryegrass	Remove clippings. Raise cutting height. Plant resistant cultivars. Moderate spring nitrogen. Daily irrigation	Mancozeb, chlorothalonil, cycloheximide, anilazine, maneb + zinc sulfate, cycloheximide + thiram, cycloheximide + PCNB, iprodione, vinclozolin
Leaf blotch	*D. cynodontis*	Bermudagrass Bentgrass, Fine-leaf fescue, Kentucky bluegrass		
Leaf spot	*D. sorokinianum*			
Melting-out	D. poae	Kentucky bluegrass		
Net-blotch	D. dictyoides	Fescue		
Red leaf spot	D. erythrospilum	Creeping bentgrass		
Stem and Crown Necrosis	D. spiciferum	Bermudagrass		
Zonate eye spot	D. giganteum	Bermudagrass		
Gaeumannomyces patch (Take all patch)	*Gaeumannomyces graminis*	Annual bluegrass Colonial bentgrass Creeping bentgrass Kentucky bluegrass Tall fescue Velvet bentgrass	Reduce soil pH. Avoid liming. Use acidic fertilizers. Sulfur.	None.
Pythium blight (cottony blight)	*Pythium* spp.		Improve soil drainage. Increase air circulation.	Chloroneb, ethazole, metalaxyl, propamocarb, hydrochloride
Red thread	*Laetisaria fusiformis*	Creeping bentgrass Colonial bentgrass Bermudagrass Annual bluegrass Perennial ryegrass Fine leaf fescues	Increase nitrogen	anilazine, iprodione, triadimefon, vinclozolin, chlorothalonil
The Snow Molds				
Typhula blight	*Typhula* spp.	Annual bluegrass Colonial bentgrass Creeping bentgrass Fine-leaf fescues Kentucky bluegrass Perennial ryegrass Tall fescue Velvet bentgrass	Avoid early fall nitrogen fertility that leads to lush growth.	Mercury compounds, PCNB products, chlorothalonil, chloroneb. These products may have to be used in combination for effective snow mold management. Benomyl, Iprodione or Mancozeb will control *Gerlachia* patch where it occurs alone.
Gerlachia patch	*Gerlachia nivalis*			
Yellow patch	*Rhizoctonia cerealis*	Kentucky bluegrass Creeping bentgrass	Nitrogen to promote recovery.	Iprodione

*The order in which fungicides are presented does not imply the order of their effectiveness.

thracnose during heat stress periods of the summer. This is not due to heat alone, as was once believed. If proper cultural management is followed, and effective fungicides are used, annual bluegrass will survive the summer heat stress period like any other perennial.

Good cultural practices consist of deep vertical mowing early in the spring, as soon as growth is initiated for the season. This will allow for the production of new juvenile growth which should be more resistant to heat stress. This should be followed by coring a week or two later for good root growth. A second coring should be made following heavy seedhead production in the late spring to provide an optimum medium for maximum root growth (the coring holes) in the few remaining weeks prior to the heat stress period. More than 70% of the annual bluegrass roots disappear during heavy seedhead production. If only one coring a year can be done, this is the time to do it. A third coring should be made when the cool nights return in late summer and early fall.

Light nitrogen application should be made (i.e. 1/2 lbs. actual nitrogen per 1000 sq ft.) in June, July and August. This produces healthier annual bluegrass and reduces the amount of inoculum produced by *C. graminicola* for subsequent infection during the remainder of the anthracnose season. Finally, one of the effective fungicides should be used to insure healthy turf.

A computer model has been developed, which predicts the occurrence of anthracnose based on average daily temperatures and continuous hours of leaf wetness. Fungicides for the management of anthracnose can now be applied when the disease occurs instead of on a calendar basis.

Snow molds

There are two prevalent snow molds in the United States: *Typhula blight* (gray snow mold) and *Gerlachia patch* (pink snow mold).

Gerlachia patch Gerlachia patch is caused by *Gerlachia nivalis*, formerly known as Fusarium patch caused by *Fusarium nivale*. Yes, another name change and this time, they not only changed the scientific name of the organism causing the disease, but the common name of the disease as well!

The disease becomes a problem in the fall when the temperature drops into the low 60's and continues through the spring, until daytime temperature climbs back into the seventies. It is usually first noticed in the shaded areas of the green, tees and fairways.

Gerlachia patch does not need snow cover to become active, only the cool wet weather. Annual bluegrass is especially susceptible to Gerlachia patch.

In the spring the disease is often misdiagnosed as copper spot, because of the small copper-colored spot that it causes. However, copper spot is a disease that occurs in warmer weather. Keeping nitrogen at low levels during the time when Gerlachia patch may be active is important in helping manage the disease

Typhula blight

Typhula blight is caused by two species, *Typhula incarnata* and *T. ishikariensis*. *T. incarnata* is the primary species in eastern, southern, and regions of the midwest and western U.S. *T. ishikarienis* is most prevelant in the more northern snow mold regions, especially where prolonged periods of permanent snow (two or more months) exist in the mid-western and western U.S.

The two typhula species are easily distinguished from each other when observed soon after the snow melts. *T. incarnata* produces grayish spots in the turf, with fairly large uncommon brown sclerotia (a mass of filaments) evident. Whereas, *T. ishikariensis* spots have a reddish cast and contain small, dark black sclerotia. Typhula blight only occurs under snow cover. It does not occur in the cool wet weather of fall and spring, except under leaf piles.

Knowing which species you have is important in chemically managing the disease. Many fungicides, including the mercuries, chloroneb(Teremec SP), PCNB(Terraclor), triadimefon(Bayleton), and chlorothalonil(Daconil) will manage Typhula blight caused by *T. incarnata*. They do not all manage Typhula blight caused by *T. ishikariensis*.

The picture also is more confusing state by state. For example, in Michigan, the mercuries, PCNB, and chlorothalonil will manage both species, but triademefon and chloroneb will not manage Typhula blight caused by *T. ishikariensis*. In northern Wisconsin and Minnesota, combinations of the mercuries and PCNB are required to manage both species. You should check with your local turfgrass experts to find out the fungicides that are effective in your area.

Gaeumannomyces patch

Gaeumannomyces (take all) patch caused by *Gaeumannomyces graminis var. avanea* was formerly known as Ophiobolus patch caused by *O. graminis*. This disease was originally thought to be confined to the Pacific northwest. It has now been reported in the coastal areas of New England, New York, and the mid-Atlantic states, primarily on creeping bentgrass turfs. A Gaeumannomyces like organism has also been reported on annual bluegrass in the mid-eastern and midwestern U.S.

In 1983, the disease caused widespread destruction on many annual bluegrass fairways in mid-August and early September. So, Gaeumannomyces patch or closely related diseases are now occurring through most of the cool-season grass regions of the United States.

Lowering the pH through the use of sulfur still appears to be the best way to manage this disease. A word of caution is necessary, the granular sulfur products have been observed to cause injury to the turf the season following application. This injury initially resembles dollar spot. The sprayable sulfurs are just as effective and do not have the bad side effects.

Fusarium blight

There are two current schools of thought on the cause of Fusarium blight. The research at Penn State University (Cole) suggests that a basidiomycete (a type of higher fungi) is involved in causing the "frog-eye" symptom associated with Fusarium blight and that, if the Fusarium fungi are involved at all, they are involved as saprophytes colonizing the dead and dying tissue.

The other school of thought, represented by Cornell University (Smiley) suggests the cause of the "frog-eye" is due to two fungi, *Leptospheria korrae* and/or *Phiolophora graminicola*. It could be we are actually dealing with three different fungi causing three different diseases, all of which have the same symptom. Time will tell which of these schools of thought are correct or if they both are.

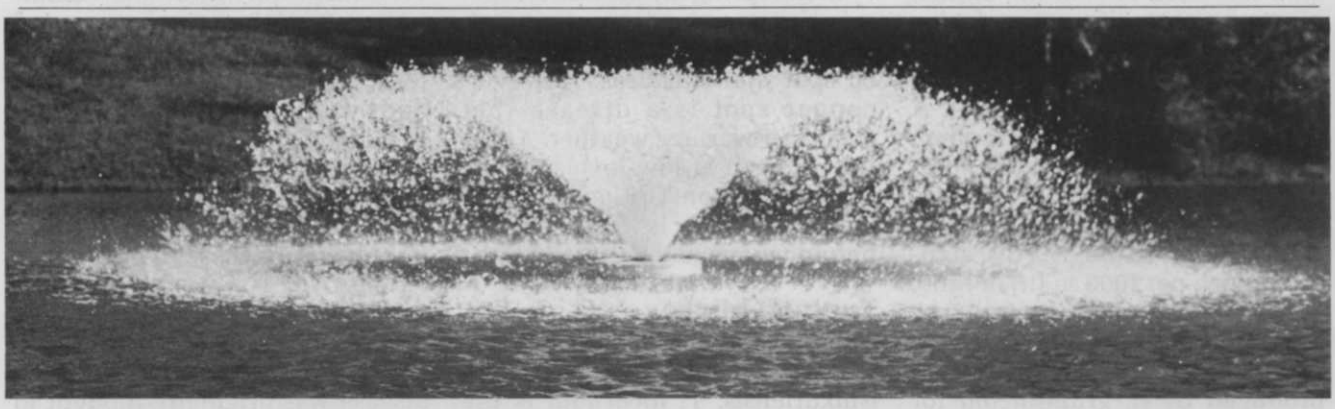
Fusarium blight is a warm weather disease that occurs from late June through early September depending on your location. The disease usually occurs after a week or two of dry weather following a heavy rain.

The characteristic initial symptom is wilted turf in the infected spot. This separates it from six other diseases that have similar "frog-eye" symptoms, like brown patch and yellow patch.

Since there may be as many as three fungi involved in the Fusarium blight syndrome, it is difficult to make specific recommendations to encompass all of them. The following are the best management recommendations available, although slight variations may exist in different areas of the country.

Cultural management Coring should be done to improve root development, reduce thatch, and eliminate layering caused by two different soil types. Homelawn turf is often grown on poor soil. Many times sod is layed on compacted subsoil because the topsoil was removed during construction.

Nutrient and water uptake are active processes which require adequate oxygen. Coring holes provide an excellent area for root growth with good aeration for proper uptake of nutrients and water.



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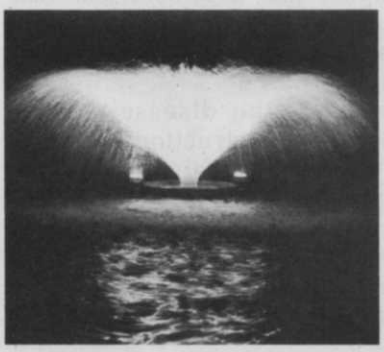

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Thatch reduction is best accomplished during the coring operation by breaking up the cores with a vertical mower or power rake, and incorporating the soil back into the thatch layer. Power raking does little for thatch reduction. It removes leaf tissue which is readily broken down but does nothing to remove the rhizomes and roots which are primarily responsible for thatch formation.

Layering results from one soil of a different type being placed on top of the other, as when a muck sod is placed on mineral subsoil.

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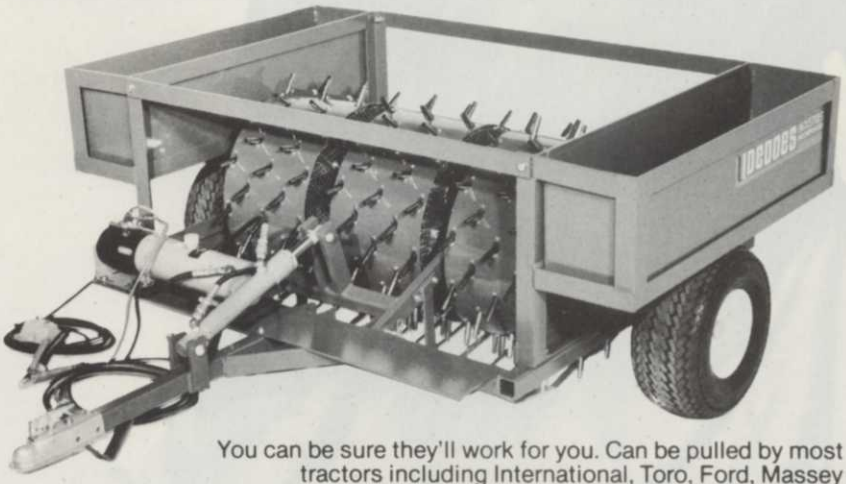

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In the cool weather of spring and fall it may not be a problem, but under stress conditions of the summer it can become a serious problem. The entire turfgrass root system is restricted to the upper layer during the summer heat stress period. This often means the root systems are no more than an inch in depth.

Obviously, drought stress diseases like "Fusarium blight syndrome" are going to be more severe under such conditions.

Integrating two soil layers over a period of years through a coring program should make for a deeper rooted, healthier turf.

Fertility Nitrogen fertility in the summer months of June, July and August, will reduce the severity of the "Fusarium blight syndrome". Approximately 1/2 lb. of actual nitrogen/1,000 sq ft./month should be adequate.

Irrigation Supplemental irrigation can culturally reduce "Fusarium blight syndrome" if applied on a daily basis. If applied at mid-day it will cool the plants, similar to syringing performed on golf courses during the heat stress period. It also provides water for the short and limited root systems of the infected plants.

If the mat or thatch is kept moist, antagonistic microorganisms may develop, which will prevent the pathogenic fungi from attacking the plants. A daily irrigation program during the summer on infected turf may also cause the build-up of antagonistic microorganisms that destroy the "Fusarium blight syndrome" fungi.

Chemical management Thiophanate(Cleary's 3336), thiophanate-methyl(Fungo 50) and benomyl(Tersan 1991), are good fungicides for the management of the "Fusarium blight syndrome". They all have the same basic chemistry.

The turf area to be treated should be irrigated the night before and the fungicides drenched in before they dry on the foliage. They can be used either cura-

tively or preventively.

The fourth fungicide, triadimefon(Bayleton), does not have to be drenched in to be effective. However, it does have to be used preventively. This means it has to be applied before the disease becomes active during the current season. This does not mean Bayleton cannot be used on turf areas that had the "Fusarium blight syndrome" the year before, only that it must be used before the disease becomes active this season.

Since more than one fungus appears to be involved in this syndrome, future research may indicate a difference in the effectiveness of these fungicides on the various fungi causing "Fusarium blight syndrome".

Yellow patch

Yellow patch is caused by *Rhizoctonia cereales* and is a newly recognized disease of Kentucky bluegrass. This is a cool weather disease that occurs in September through November, depending on your location.

The initial symptoms are red to purple leaves on the infected plants. The disease is characterized by "frog- eyes" which resemble the "Fusarium blight syndrome". Consequently, the disease is often mis-identified as Fusarium blight. The main differences between the two diseases are "Fusarium blight syndrome" occurs in warm weather and is characterized by wilting turf in the active spots, whereas yellow patch occurs in the cool weather of the fall and is characterized by the red blades on the infected grass plants.

Cultural management Nitrogen fertility during the growing season is necessary for recovery of the older yellow patch "frog-eyes" that were formed in previous seasons. The effect nitrogen has on development of new yellow patch "frog-eyes" has not been determined.

There are some products which claim to change the chemical and biological activity of soil and thatch to make it a better environment for biological activity of beneficial microorganisms and healthier plant growth. Several products were tested for their management of Rhizoctonia yellow patch and some promoted excellent recovery of older yellow patch "frog-eyes" and prevented new ones from forming. They were Lawn Keeper and Green Majic. It is important to point out these are only preliminary findings and further research is needed to check the repeatability of these results and to determine rates, timing and the exact effect the products are having on disease reduction.

Chemical management Preliminary data suggest that iprodione(Chipco 26019) and fenarimol(Rubigan) will manage Rhizoctonia yellow patch. Effective timing and minimal rates have to be determined. It appears nitrogen application will have to be made in conjunction with the fungicide. Otherwise, fungicides may prevent the older "frog-eyes" from becoming active again and new ones from forming. Also, the older "frog-eyes" will not fill in and the maximum benefit from the fungicide treatments will not be realized.

Melting-out

This disease is often incorrectly referred to as leaf spot. To be correct, melting-out is caused by *Dreschlera poae*(formerly *Helminthosporium vagans*) and is a disease of Kentucky bluegrass that occurs in the cool, wet weather of spring. The disease starts out as spots on the leaf blades and in a 2-3 week period, rapidly moves down the leaf sheath and into the crowns and roots. The entire grass plant is often killed or severely damaged during this period, which is where the term melting-out arises. The entire stand of Kentucky bluegrass seems to melt away.

Leaf spot, on the other hand, is a warm weather disease of many grass species caused by the fungus *Drechslera sorokinianum* (formerly *Helminthosporium sativum* and sometimes currently referred to as *Bipolaris sorokinianum*). Are you thoroughly confused now? Don't feel bad, you're not alone.

There are many Kentucky bluegrass cultivars that are resistant to melting-out. The first resistant cultivar was 'Merion' which had excellent resistance to melting-out. Some of the newer Kentucky bluegrass cultivars, i.e. Parade, Baron, Cheri, Majestic, etc., have some resistance to melting-out, although it is not the same excellent resistance 'Merion' had. Consequently, stands of some of the newer Kentucky bluegrass cultivars may be thinned by melting-out in the spring, allowing for invasion by crabgrass, quackgrass, tall fescue and/or broadleaf weeds. This means cultural, biological and chemical management practices to reduce the severity of melting-out will have to be incorporated into your turf management programs.

Helminthosporium melting-out is one of the oldest, most written about, turfgrass diseases. Unfortunately, much of what has been written about the disease, is based on "folk law" and not good scientific data.

First, much of the older literature refers to melting-out having a "leaf spot stage" in the spring, during the cool, wet weather and a "melting-out stage" during the hot weather of the summer. Anyone who is familiar with the disease knows all the damage is done during the cool, wet weather of spring. With the arrival of warm weather the turf begins to recover.

Secondly, practically all the literature says to avoid spring nitrogen, because it will increase the severity of Helminthosporium melting-out. It appears the research that lead to the erronious conclusion was based on greenhouse data and not field. At Michigan State University, data from

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the last four years suggests just the opposite. Nitrogen in the spring actually reduces the severity of Helminthosporium melting-out. We recommend two nitrogen applications during the spring period to help manage Helminthosporium melting-out. Each applicatioon should be between 1/2-1 lb. of actual nitrogen/1000 sq. ft.

The third management practice is biological in nature. It consists of daily irrigation to keep the mat or thatch moist, to encourage the build up antagonistic microorganisms that prevent the fungus D. poae from sporulating, or germinating, or infecting. There is also a possibility that these antagonistic microorganisms may even destroy D. poae. While the details have not been worked out, the results have shown a dramatic reduction in the amount of Helminthosporium melting-out, where light daily irrigation has been applied.

The actual concept may be hard to grasp since the disease occurs under cool, wet weather conditions, but apparently just a few days without rain, allows the top of the thatch to become dry and allows the D. Poae fungus to grow and infect these grass plants. You aren't irrigating the turf, you are irrigating the thatch to keep it moist.

Following good cultural and biological practices will help improve the disease management obtained with the fungicides. For the people in the lawn care business, there are now three excellent fungicides which will manage Helminthosporium melting-out during the 3-4 weeks it is normally a problem in the spring; iprodione(Chipco 26019), vinclozolin(Vorlan), and chlorothalonil(Daconil). There is a possiblity that anilazine(Dyrene) may also manage the disease for the desired period of time, although more research is needed. Remember, applying these fungicides with a little nitrogen will make them more effective. **WT&T**