FROG-EYE DISEASES*

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The "frog-eye symptom is characterized by a circular pattern with a brown dead grass outer ring surrounding a more or less healthy green center. The circular pattern is predictable since fungi grow from a single point unless impeded. The fungi that cause soilborne diseases usually originate from a single point in the thatch or soil and also grow in a circular pattern unless impeded. In fact, the only fungi that cause diseases that are not circular in nature are the ones that cause foliar diseases like the rusts, the Helminthosporium diseases and powdery mildew.

The frog-eye pattern occurs one of two ways. This pattern may be formed by the fungus growing in the thatch or soil as a saprophyte where it lives on the dead organic matter early in its development. Later, when the actively growing part of the fungus is in the outer perimeter of the ring it becomes pathogenic and kills the grass. The part of the fungus that was in the center of the circle has either become dormant or has died leaving the center of the circle healthy.

The second type of "frog-eye" symptom occurs when the fungus is pathogenic from the onset or shortly after it begins growth as a saprophyte in the thatch or soil. In this case most of the grass in the circle is destroyed, leaving a solid dead spot. The following season the fungus usually remains active only in the outer edges of the ring. New plants may develop in the center of the dead spot from rhizomes or from plants that were only damaged and not killed. After a turf has been infected for a period of 3 years it is impossible to distinguish the difference between the two types of "frog-eye" symptoms.

"Frog-eye" Diseases of Cool Season Grasses

Kentucky bluegrass is the major cool season turfgrass species grown on home lawns. it is susceptible to "frog-eye" diseases, such as Fusarium blight (causes to be discussed later), Rhizoctonia brown patch, caused by Rhizoctonia solani and yellow patch caused by Rhizoctonia cerealis. The symptoms of these diseases are all similar and it is difficult to tell them apart, especially when the diseases are not active.

Before discussing the differences among these 3 "frog-eye" diseases, we need to discuss the latest findings on just when Fusarium blight is. The two current schools of thought seem to agree on one thing, that Fusarium blight is not caused by either Fusarium roseum or Fusarium tricinctum. The research at Penn State University suggests that a basidiomycete 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. They suggest the basidiomycete is either causing the frog-eye by directly attacking the turfgrass plants or by making the soil hydrophobic as do the fungi that cause localized dry spot or fairly ring.

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The other school of thought resresented by Cornell University suggest the cause of the "frog-eye" is due to a species of Leptospheria korrae and/or Phialophora graminicola. It could be we are actually dealing with 3 different fungi causing three different diseases, all of which have the same symptom .

Regardless of what the cause, the disease still commonly referred to as Fusarium blight" has initial symptoms that separate it from the other "frog-eye" diseases. It 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. It is later in the development of the disease that the "frog-eyes" form.

Rhizoctonia brown patch is also a warm weather disease that usually occurs in July and August during hot humid weather. These circles are initially characterized by plants withe dark brown foliage. These plants eventually thin and become yellow in appearance. This disease doesn't always form "frog-eyes" but this symptom occurs with enough frequency to cause confusion with Fusarium blight during warm weather periods. The spots caused by brown patch normally fill in and recover in the cool weather of fall.

The third disease is yellow patch caused by R. cerealis. 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 infected plants eventually die and become straw colored in appearance. "Frog-eyes" are formed initially as well as later in the disease development.

While these diseases are relatively easy to distinguish when they are active, they are difficult to distinguish when they are dormant. This is especially true in the spring when you arrive at a new customers lawn and try to diagnose the problem that occurred last season so you can treat it properly. Your best bet is to try and determine from the homeowner the time of year the disease "first" occured. If it was in the warm weather, it is probably "Fusarium blight". If it occurred in the cool weather, it probably is yellow patch. Remember that Rhizoctonia brown patch infected spots normally recover in the cool weather of the fall.

MANAGEMENT OF "FROG-EYE" DISEASES

The disease called "Fusarium blight"

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 and among the different fungi causing the diseases. The management principles are summarized in Table 1.

Resistant cultivars. This information should be obtained from your local turf expert, since both climate and soil conditions vary greatly throughout the cool season turfgrass areas. Secondly, there are often other diseases that have to be taken into account when recommending cultivars. Finally, there are other factors such as quality, color, texture, wear tolerance, competitiveness with other grasses and weeds, etc., which should be taken into account when selecting a cultivar.

Cultural Management

Cultivations. Coring should be done to improve root development, reduced 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 sub soil because the top soil was removed during construction. Nutrient and water uptake are active processes which require adequate oxygen. Coring holes provides an excellent area for root growth with good aeration for proper uptake of nutrients and water. 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. This often occurs in the homelawn situation after sodding where, for example, much sod is placed on mineral subsoil. 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 the "Fusarium blight syndrome are going to be more severe under such conditions. Integrating the 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 the syringing that is done on golf courses during the heat stress periods. It also provides water for the short and limited root system of the infected plants.

Biological. 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 turfs infected with the "Fusarium blight syndrome" may also cause the build-up of antagonistic microorganisms that destroy the Fusarium fungi. The daily irrigation method of disease management is often criticized because it will cause short root development. In cool-season turfgrasses, such as Kentucky bluegrass, root shortening is a natural occurrence during the summer months due to warm soil temperatures. Deep infrequent irrigation won't cause the formation of deep roots during this period, nor will light frequent irrigation shorten them. Most customers are more concerned with green healthy turf than with deep roots. Furthermore, deep roots on 50% of the lawn and no roots in the disease patch won't thrill them either. If you're skeptical, try to use the deep root excuse as the reason they have to tolerate the "frog-eyes" in their lawn and see how far you get!

Chemical Management

Cleary's 3336, Fungo 50 and 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 curatively or preventatively to control the "frog eyes" caused by the "Fusarium blight syndrome". The fourth fungicide, Bayleton have to be drenched in to be effective. However, it does have to be used as a preventative fungicide. This means it has to be applied before the disease becomes active during the current season. If two applications are made, the

first should be applied 1 month before the disease normally appears with a second application about one month later. If only one application of Bayleton is made, it should be applied 2 weeks prior to the normal occurrence of the disease. Regardless of which approach is taken, following good cultural and biological management practices will make the fungicides more effective.

Table 1. Management the "Fusarium blight syndrome".

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1. Resistant Cultivars
   a. Check with local turfgrass specialists for recommendations.
2. Cultural
   a. Core cultivation
      1) Improved root growth
      2) Thatch modification
      3) Eliminate layering
   b. Daily irrigation - foliar cooling
   c. Light nitrogen application during the summer
3. Biological
   a. Daily irrigation to build up antagonistic microorganisms
4. Chemical
   a. Preventative or curative
      1) Cleary's 3336
      2) Fungo 50
      3) Tersan 1991
   b. Preventaive only
      1) Bayleton

Rhizoctonia Brown Patch Management

Resistant Cultivars

Most Kentucky bluegrass cultivars have good resistance to Rhizoctonia brown patch as demonstrated by their quick recovery in the cool weather of the fall. Perennial ryegrass lawns or mixtures of perennial ryegrass and Kentucky bluegrass will be more susceptible to this disease.

Cultural Management

High levels of nitrogen increase the severity of Rhizoctonia brown patch. No more than 1/2 pound actual nitrogen/1000 sq ft/month should be applied as warm weather approaches. Pruning trees or removing shrubs to increase air incubation will also help reduce the severity of the disease.

Chemical Management

See Table 2.

Table 2. Recommended fungicides for the management of Rhizoctonia brown patch.

Chemical management:	1.	Daconil 2787
	2.	Proturf 101V
	3.	Actidione RZ
	4.	Dyrene
	5.	Dymec 50
	6.	Proturf
	7.	Fungicide III
	8.	Ortho Dyrene Lawn
	9.	Disease Control
	10.	Chipco 26019
	11.	Fore
	12.	Formec
	13.	Lawn Disease Preventer
	14.	Proturf FII
	15.	Turfcide
	16.	Bromosan
Cultural management:	1.	Reduce Nitrogen prior to warm weather
	2.	Increase air movement

Yellow Patch Management

Reistant cultivars

Good critical data on cultivars that are resistant to this disease is lacking at this time.

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.

Biological

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 are listed in Table 3. It is important to point out these are only preliminary findings and further research is needed to determine rates, timing and the exact effect they are having on disease reduction.

Chemical

As with biological management, the data are only preliminary but they suggest that Chipco 26019 and Rubigan will manage Rhizoctonia yellow patch. Effective timing and minimal rates have to be determined. It does appear that 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 but the older frog eyes will not fill in and the maximum benefit from the fungicide treatments will not be realized.

A final word of caution is necessary in diagnosing "frog eye" disease. It has been my experience that insect problems are often misdiagnosed as "frog eye diseases". Grubs, bill bugs, and web worm damage is often diagnosed as "frog eye" diseases. While you may be able to imagine "frog eye" disease in insect damaged lawns, there are usually not definite sunken rings present.

Table 3. Management of yellow patch.

Management:	Chemical 1) Chipco 26019 2) Rubigan Biological 1) Lawn Keeper 2) Green Magic 3) Relief Cultural 1) Nitrogen for recovery