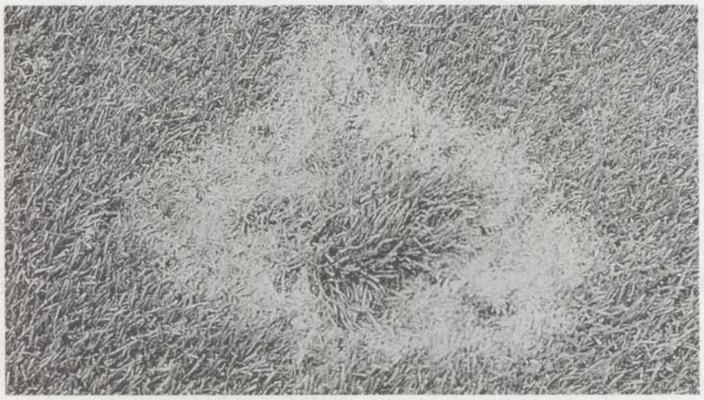
AN INDEPENDENT NEWSLETTER FOR COOL SEASON TURF MANAGERS

Turf Grass TRENDS

Issue 1

June 1992



"Frog-Eye" symptom of Summer Patch. Test results seem to indicate that the classic "frog eye" symptom shown here is either an early sign of infection or an indication of very high local concentrations of the fungus.

Summer Patch

The biology and conditions that favor its growth

by Dr. Eric B. Nelson

SUMMER PATCH IS ONE OF A GROUP of major turf management problems commonly referred to as "patch diseases." These diseases are all characterized by circular areas of dead and dying turf that result from root, crown, and rhizome infections by related, but quite distinct fungi. The most common patch diseases affecting cool season turfgrasses are Summer Patch, Necrotic Ring Spot, and Take-all Patch. Summer Patch and Necrotic Ring Spot were formerly grouped under the disorder called "Fusarium blight syndrome." Summer Patch and Necrotic Ringspot are primarily diseases of Kentucky bluegrasses, annual bluegrass, and fine-leafed fescues. Take-all Patch is primarily a disease of bentgrasses.

Complications

CONTROL STRATEGIES FOR SUMMER PATCH are complicated by several factors:

- UNLIKE MOST foliar turgrass diseases, there is a time difference between the infection period and the appearance of symptoms,
- THE CONCURRENT PRESENCE of other diseases with similar symptoms,
- AND EFFECTIVE LONG-TERM treatment may require a combination of actions designed to address underlying factors that contribute to its reappearance.

The infection of a turf stand and the expression of the disease's symptoms usually do not occur simultaneously. Thus, although Summer Patch is typically considered a disease of mid- to late summer, management strategies must be initiated in mid-spring to achieve the most effective control.

The second complicating factor is that the symptoms of Summer Patch are often similar in appearance to those of other root and crown diseases—and also to damage caused by various environmental conditions and insect infestations. It is not uncommon to find symptoms of Necrotic Ring Spot, Pythium Blight and Pythium Root Rot together with the symptoms of Summer Patch.

If a turf stand is subject to attacks by other root infecting fungi, such as Pythium Root Rot or Necrotic Ring Spot, then the damage from subsequent or concurrent attacks of Summer Patch can produce truly disastrous results. The limitations of space do not allow a full discussion here of how to identify and treat these other problems. Nonetheless, a turf manager needs to be informed about them, and to coordinate treating them, if they are present, with his treatment of Summer Patch.

Thirdly, beyond the fungicidal control of acute symptoms, control strategies may have to include both modifications to cultural practices and actions aimed at correcting site specific conditions favoring Summer Patch. These site conditions are useful in helping to determine whether the problems at a particular site are, in fact, due to Summer Patch. Sample control strategies are discussed in-depth in Christopher Sann's article *(see page 6).*

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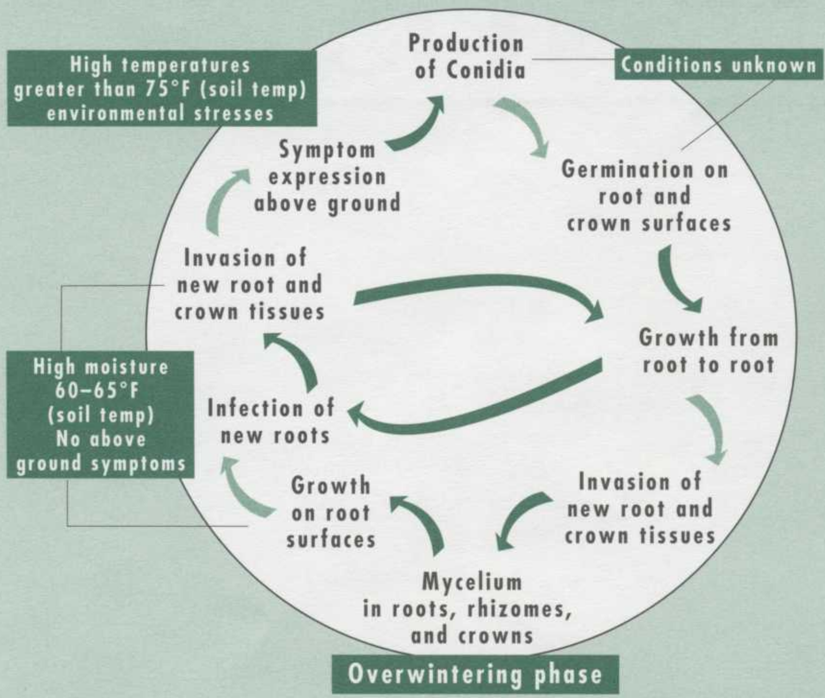
Summer Patch Disease Cycle



Magenporthe poae, the pathogen causing Summer Patch, survives in a dormant state in infected roots, crowns, and rhizomes. When soil temperatures warm in the spring, the pathogen resumes growth and is able to colonize newly-developing root and rhizome tissues and may easily spread along roots and rhizomes to adjacent plants.

Actual penetration and infection of roots occurs when soil moisture levels are relatively high and soil temperatures stabilize around 60–65°F (15–18°C). Once soil temperatures reach 75°F (24°C) or greater, symptoms become visible above-ground.

Although the fungus is capable of producing two types of spores in the laboratory, the role of these spores in nature is unknown. However, it is likely that the fungus could sporulate on root, rhizome, and crown surfaces, and these spores could then be disseminated to adjacent plants and roots. The conditions that might regulate this stage of the disease cycle are unknown. Once plants are infected, they are likely to remain infected going into dormancy, where the fungus again will survive through the winter months in a dormant state.

Roots and rhizomes thus damaged typically will turn brown and brittle as the disease progresses underground—without causing any apparent above-ground symptoms. The infection can persist in damaged roots and rhizomes—acting as a re-infection source for years.

Biology of *M. poae:* infection and initial growth

SUMMER PATCH IS CAUSED by the root-infecting fungi *Magenporthe poae.* Plants become infected with *M. poae* during mid to late spring—when soil moisture is relatively high and soil temperatures reach 60–65°F (15–18°C). Under these conditions, the fungus colonizes and damages turf root systems, while the plants remain asymptomatic.

The fungus grows as an ectotropic mycelium over the root and rhizome surfaces. This dark brown mycelial growth can be seen with a high-powered hand lens or a low-powered microscope and can be a useful key in identifying Summer Patch *(see photo page 7).*

The Summer Patch fungus can grow over a wide range of soil temperatures. Although *M. poae* may grow more slowly under less than ideal conditions, its habit of growing on the surface of roots, rhizomes, and crowns allows the fungus to spread readily from root to root and plant to plant.

Growing along the outside surface of the roots, *M. poae* damages turf plants by driving a short peg down into the cortex of the root. Once in the cortex, the fungus expands and blocks the upward flow of nutrients and water. This process can occur at multiple sites along the root—thereby causing the rapid decline of an infected root. Roots and rhizomes thus damaged typically will turn brown and brittle as the disease progresses underground—without causing any apparent above-ground symptoms. The infection can persist in damaged roots and rhizomes—acting as a re-infection source for years.

Initial symptoms

SUMMER PATCH SYMPTOMS first appear later in the season—well after periods of peak root infection. Above-ground damage frequently appears during hot 85–95°F (29–35°C) weather immediately after a prolonged wet period.

Knowing what kinds of locations are more prone to develop Summer Patch will help you make a positive identification of the disease. Site-specific factors may be contributing to outbreaks of Summer Patch in:

- SUNNY AREAS NEAR PAVING OR BUILDINGS
- SOUTH AND EAST FACING AREAS

Any practice that induces undue stress on turf plants, or restricts their root development, will accentuate the disease. For example, excessively low mowing heights will reduce the root mass and thus enhance the potential of Summer Patch damage.

The new sod on the right presents a stark contrast to the turf on the left, which shows extensive Summer Patch damage. The initial small circular patches have combined to form large bare patches. Turf managers need to take long-term actions that not only eliminate gross symptoms, but prevent re-infection.

- AREAS AT THE BOTTOM OF A SLOPE, but generally not on the slope itself
- POORLY DRAINED AREAS and those with compaction problems

The initial symptoms appear as small patches of thinning, dead, or dying turf that look very much like symptoms of Pythium Root Rot. During these initial stages of the disease, patches may range in size from 1–3"(26mm–78mm). As the disease progresses in the first year of symptom expression, the patches may grow up to 12"(312mm) in diameter. At this stage, the patches may appear crescent-shaped or donut-shaped—with healthy turf in the center. Diseased turf within the patch may take on a yellow or reddish-brown to straw-colored tan appearance, depending on the grass species, temperature, and moisture conditions. In general, the dead turf remains erect until knocked down either by traffic or irrigation. Under severe conditions and high levels of disease incidence, patches may coalesce to form large areas devoid of turf.

The role of general conditions and cultural practices

GENERALLY, STRESSES INDUCED BY CHEMICAL, physical, or environmental factors will enhance the expression of symptoms; however, drought stress has been shown to have the opposite effect. In two tests of the effect of drought stress, one plot was watered on a regular basis and the other one only on evidence of drought stress—wilting. Both plots were inoculated with a high concentration of *M. poae,* and both developed Summer Patch symptoms. However, in the first test, the patches in the well-watered plots were as much as

Fungicides for controlling Summer Patch

Common Name	Trade Name	Formulation*	Application Rates (per 1000 ft.^{2})	Cost Range (per 1000 ft.^{2})**
Benomyl	Tersan 1991	50W	5 oz.	\$4.74–5.47
			8 oz.	\$7.59–8.74
Fenarimol	Rubigan	50W	2 oz.	\$ not available
		1AS	4 oz.	\$7.13-8.05
Propiconazole	Banner	1.1E	4 oz.	\$6.94–8.52
Thiophanate methyl	Fungo	50W	8 oz.	\$8.79–9.88
		46F	10 oz.	\$9.27–12.35
Triadimefon	Bayleton	25W	4 oz.	\$6.96–9.13

* W = wettable powder, AS = aqueous solution, E = emulsifiable concentrate, F = flowable
** *Turf Grass Trends* does not recommend basing purchasing and use decisions solely on price. Prices for specific products vary according to time, availability, volume discounts, special sales, and other factors that *Turf Grass Trends* cannot track. The numbers given should be used only as sample ranges.

A CLOSER LOOK

In the lab *M. poae* demonstrates explosive growth rates

GROWN UNDER LABORATORY CONDITIONS at four different temperature levels, ranging from 68–95°F (20– 35°C), *Magenporthe poae*, the fungus that causes Summer Patch, showed its ability to grow at devastating rates in less than one week. At 68°F (20°C) the colony increased an average of 510% in six days. At 77°F (25°C) it increased 980% in six days. At 86°F (30°C) it increased 977%, and at 95°F (35°C) it increased 1,000% in six days.

The bottomline is that, based on growth rates alone, this fungus can potentially damage roots up to eight times faster at 77–86°F (25–30°C) than at 68°F (20°C).

The study results indicated that growth rates began to accelerate at temperatures below 68°F (20°C) and reached its maximum growth rates at 77–86°F (25–30°C). Also, at 95°F (35°C), the growth stopped after two days and did not increase thereafter.

This study also demonstrated a relationship between Summer Patch growth rates and available water. After four days, maximum growth was achieved between 68–86°F (20–30°C) under high to saturated moisture conditions. Growth increased by about 100% between 68–77°F (20–25°C) and then increased an additional 20% between 77– 86°F (25–30°C).

The bottomline is that, based on growth rates alone, this fungus can potentially damage roots up to eight times faster at 77–86°F (25–30°C) than at 68°F (20°C). At 77°F (25°C) researchers have recorded growth rates of .5" (13mm) in one day. Another study—of soil temperatures at a depth of 2.33" (59mm)—showed that the peak *M. poae* temperature range of 77–95°F (25–35°C) was reached in the last two weeks of July and the first week of August. Combined with the fact that these higher temperatures are ideal for *M. poae,* turf is particularly susceptible because at 77°F (25°C) most turfgrass's natural root growth is severely impaired. ■

11% larger than the drought-stressed plots. In the second test, the patches in the well-watered plots were as much as 58% larger. These results confirm the importance of high soil moisture in the development of Summer Patch. Because of complications with other factors, drought stressing turf is not a recommended way of reducing Summer Patch problems.

Despite fairly high levels of root infection, Summer Patch symptoms will generally not develop if soil temperatures do not exceed 70–75°F (21–24°C). This is primarily due to two facts: turf root growth can be quite restricted at soil temperatures above 75°F (24°C), and soil temperatures above 75°F (24°C) are more ideal for the growth and reproduction of *M. poae.*

Frequently, Summer Patch symptoms are first evident adjacent to sidewalks, driveways, and buildings with south-facing exposures—where soil temperatures may be elevated. As already indicated, high soil temperature, accompanied by high soil moisture, is important in favoring the activity of *M. poae.* In particular, sites with poorly-drained or highly compacted soils are especially prone to damage, as are areas where considerable thatch has accumulated.

A number of management practices can affect the severity of Summer Patch. Any practice that induces undue stress on turf plants, or restricts their root development, will accentuate the disease. For example, excessively low mowing heights will reduce root biomass and thus enhance the potential of Summer Patch damage.

The use of quick-release forms of fertilizers also enhances symptoms of Summer Patch. Studies have demonstrated that turf fertilized with soluble forms of nitrogen—such as urea, ammonium chloride, or sodium nitrate—can be more severely damaged by Summer Patch than turf fertilized with slower release forms—such as sulfur-coated urea. According to studies at the University of Maryland, using sulfur-coated urea fertilizers, instead of cold water soluble fertilizer sources of nitrogen, can reduce Summer Patch damage by an average of 35% during the peak period of July through mid-September.

Reacted forms of urea, such as methyline ureas and urea formaldehydes, should produce similar—or even better—reductions. Research on general, long-term turf quality indicates that water soluble nitrogen sources can dramatically improve the quality of turf in a short time period; however, continued use appears to lead to a decline in quality. Water insoluble nitrogen sources take longer to achieve the same level of overall quality, but their continued use appears to sustain the level of improvement.

Peak conditions

WHILE THE SUMMER PATCH FUNGUS GROWS in soil temperatures ranging from 50–105°F (10–40°C), maximum growth occurs in the 77–86°F (25–30°C) range. These soil temperatures (77–86°F) can occur during the months of May through September on short-cut turf (1.5"[39mm] or less) and during the months of June through August on tall-cut turf (3.0"[78mm] or more). In an average season, maximum soil temperatures generally occur in the last two weeks of July and the first two weeks of August.

Soil moisture levels present a similar picture. The range of moisture levels over which the fungus can grow are just below saturation to near the permanent wilting point. The maximum growth rate occurs at a range from slightly less than field saturated to slightly higher than field saturated.

By themselves these two environmental conditions are

Resistant grass varieties

Kentucky bluegrass

THE FOLLOWING VARIETIES OF KENTUCKY BLUEGRASS ARE RESISTANT TO SUMMER PATCH.

Able 1	**America**	**Baron**	**Challenger**	**Eclipse**	**Estate**	**Midnight**	**Nassau**	**Ram 1**
Adelphi	**Banf**	**Bristol**	**Columbia**	**Enmundi**	**Glade**	**Mystic**	**Princeton**	

Different turf species respond differently

TESTS OF THE NATURAL RESISTANCE of four turfgrass species other than bluegrass to *M. poae,* which was inoculated and incubated at 82°F (28°C), showed the following results:

Turf species	**% TURF DECLINE:** Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Creeping fescue	0	2	20	25	47	74
Creeping bentgrass	0	2	3	25	52	69
Tall fescue	0	2	6	13	26	28
Perennial ryegrass	0	0	0	0	3	20

- FINE FESCUES AND BENTGRASSES showed about the same high susceptibility to *M. poae,* while tall fescue showed moderate susceptibility, and perennial ryegrass showed the least.
- THE AGE OF A STAND OF TURF CAN ALSO AFFECT THE GROWTH RATE of Summer Patch. Tests on seven-year old sod, eight-week old Poa, and 8-week old Merion ultimately showed the same results, but with substantially different time lines.

  On seven-year old sod established on a growing medium two weeks before inoculation, a substantial 40% reduction in turf quality was seen after three weeks, a 50% reduction was reached around four weeks out, and a 98% reduction in quality was reached after six weeks. The same test of eight-week old Merion and Poa produced the same 50% reduction after three weeks, but the 98% reduction level was reached in just four weeks.
- AREAS DAMAGED, OR PRONE TO DAMAGE BY *M. POAE* should be overseeded with resistant bluegrass varieties for light to moderate infections and perennial ryegrass or tall fescue for heavy infections. ■

important, but together they can produce a set of conditions—field saturated and 77–86°F (25–30°C)—that encourages maximum fungal growth. Under this combination of these conditions, this explosive growth can lead to massive turf death in 17 to 29 days from the onset of these conditions.

Conclusion

THE COMPLEXITIES DISCUSSED HERE, which make identifying and effectively controlling Summer Patch so challenging, represent a strong argument for taking a comprehensive, long-term approach. In plain English, it pays to be well-informed and well-organized, when dealing with Summer Patch; otherwise, even massive short-term attempts to alleviate the problem may well end in failure.

To facilitate this approach, this issue of *Turf Grass Trends* includes a Summer Patch sampler *(see page 9)*, which provides an overview and treatment of three different kinds of infected sites, and a Summer Patch Site Survey and Quick Reference Guide *(see pages 10–11)*, which readers can use to evaluate their own problem sites and to develop appropriate action plans. ■

Further readings on Summer Patch

IF YOU WOULD LIKE TO READ MORE about *Magnaporthae poae,* the fungus that causes Summer Patch, we recommend the following articles:

■ **Phytopathology 80**
(A Journal of the American Phytopathology Society)
"Pathology of some ectotropic fungi with Phialophora anamorphs that infect the roots of turfgrass" by Landschoot, P. J. and Jackson, N., 1990, pgs. 520–526.

"Growth of Magnaporthae poae and Gaeumannomyces incrustans as affected by temperature-osmotic potential interactions" by Kackley, K. E., Grybauskas, A. P., and Dernoeden, P. H., 1990, pgs. 646–650.

"Influence of temperature-soil status interactions on the development of Summer Patch in Poa spp." by Kackley, K. E., Grybauskas, A. P., and Dernoeden, P. H., 1990, pgs. 650–655.

"Role of drought stress in the development of Summer Patch in field-inoculated Kentucky bluegrass" by Kackley, K. E., Grybauskas, A. P., and Dernoeden, P. H., 1990, pgs. 655–658.

■ **Agronomy Journal Vol. 83, No. 3**
"Summer Patch and Kentucky bluegrass quality as influenced by cultural practices" by Davis, D. E., and Dernoeden, P. H., 1991, GPs. 670–677.