

Patch disease co-factors

A host of unrecognized, contributing factors

by Christopher Sann

CONSISTENTLY CONTROLLING Patch disease damage in the field is frustrating. Compounding the problem, some turf managers and lawncare operators—all of whom are human beings, after all—may have difficulty admitting that they don't know what is happening. Few bosses or customers want to hear that. The result is that a turf professional may be tempted to simply ignore the damage, or to try a variety of “stab in the dark” corrective measures—some of which can actually intensify the damage. Both methods can ultimately lead to the loss of a job or loss of customers.

Turf managers could relieve much of their frustration, if they would take the time to understand the idea of patch disease co-factors and the role that they play in the appearance of visible patch disease damage.

What are co-factors?

PATCH DISEASE CO-FACTORS are any conditions that adversely affect the turfgrass host in a way that contributes to the development of visible patch disease damage. They are the added ingredients that tip the natural balance, which exists between the host and the disease pathogen, from a non-visual state toward the symptomatic or visible state. Frequently, patch disease co-factors are conditions that affect the size and health of the host plant's root system.

One success hasn't lead to another

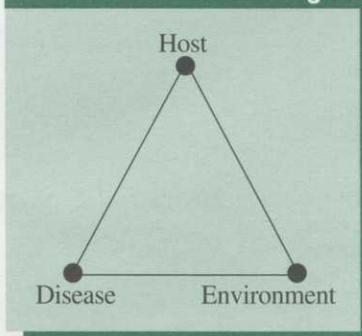
SUCCESSFUL TURFGRASS MANAGERS are familiar with the three factors that make up the classic disease infection triangle:

- THE HOST
- THE DISEASE CAUSING PATHOGEN
- AND THE ENVIRONMENT in which both host and pathogen live.

Also, many managers have observed that, with common foliar diseases of turfgrass, there is a straight line, linear relationship between the infection and the appearance of symptoms.

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Classic Disease Triangle



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tion and symptoms has been essential to control most of the foliar diseases. This understanding has led to an unprecedented ability to control most foliar turfgrass diseases. Unfortunately, as a model for understanding and controlling other types of turf diseases—this linear paradigm, or model, has hindered understanding the biology—and the control—of patch diseases. They don't fit the mold.

Unlike foliar diseases, all patch disease pathogens attack the root system of the host plant before any foliar symptoms appear. Also, unlike foliar diseases, patch disease pathogens range from slow to very slow in terms of the speed with which they can damage host plants. With foliar diseases, after the initial infection, the appearance of symptoms only takes somewhere from a few hours to a few days. In contrast, the onset of visible symptoms caused by patch diseases can take weeks, months and even years (*see chart page 7*).

This long delay between the initial infection period and the appearance of symptoms—combined with turfgrass managers historical tendency to look for a more linear relationship—is at the core

of much of the misunderstanding, and the incorrect diagnosis of, patch diseases.

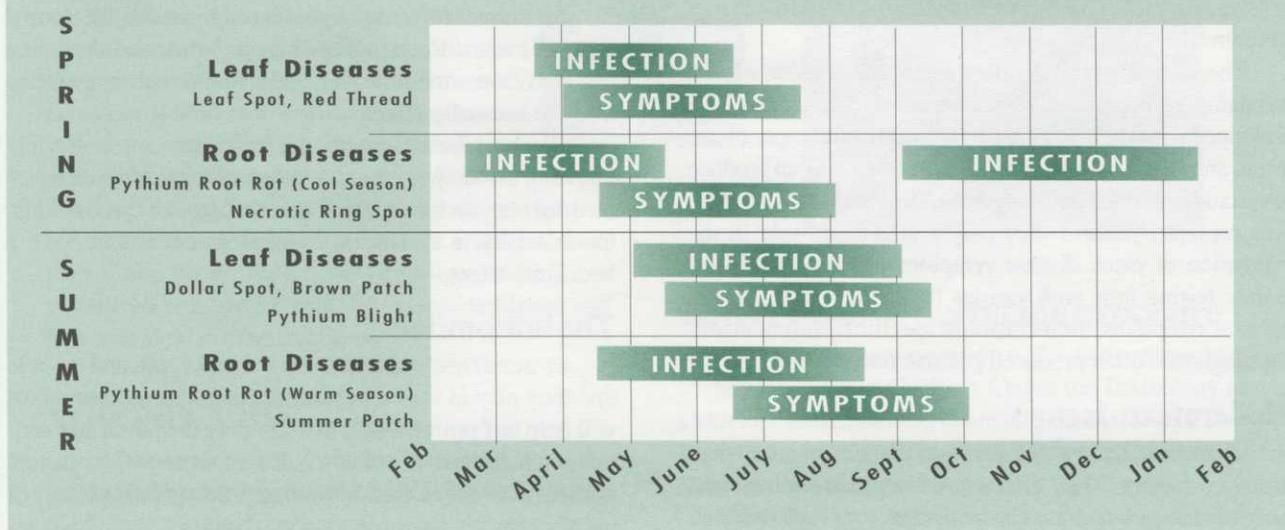
Why are co-factors important?

CO-FACTORS ARE FREQUENTLY THE CATALYST between the initial infection or root damaging period and the onset of symptoms. If the co-factor has a strongly deleterious effect on the health of the host, then the symptoms will appear quickly. If the co-factor's effect on the host is less severe, then the symptoms can take considerably longer to appear. The weakest co-factors often require the addition of a second, or even third, co-factor to bring on visible symptoms. Often, patch disease infection will not produce any obvious symptoms—either because an element of the disease infection triangle has been removed, stopping the infection, or there are no co-factors of sufficient strength to adversely affect the health of the host.

Different groups of co-factors

CO-FACTORS CAN GENERALLY BE DIVIDED into three groups—strong, moderate and weak:

Infection and Symptom Relationships



- **STRONG CO-FACTORS** are conditions that either actively damage a host's root system or severely restrict its growth. Strong co-factors combine with the patch disease pathogens to produce symptoms within weeks.
- **MODERATE CO-FACTORS** are those conditions that weaken the host or limit its ability to recover. Moderate co-factors typically produce symptoms in a period of months.
- **WEAK CO-FACTORS** are conditions that often require one or more additional co-factors to produce visible symptoms. Weak co-factors can take many months or even years to produce symptoms. Without additional co-factors, weak co-factors sometimes produce chronic—rather than an acute—symptoms that persists for years. Chronic symptoms may manifest themselves as a nondescript, poor quality turf—a turf that is slow to react to normal maintenance—or one that is vulnerable to persistent infestations from opportunistic diseases, such as Nigrospora or Red Thread.

Strong co-factors

STRONG CO-FACTORS CAN GENERALLY be divided into two groups—physical/chemical and pathogenic. Of these two groups, the physical/chemical group is the largest and are probably the least recognized as contributing to the appearance of patch disease symptoms.

Both mechanical and chemical soil compaction reduce root hair growth, by eliminating soil pore spaces—the spaces between the various particles that make up the soil. There are many kinds of mechanical soil compaction:

- **THE COMPACTION OF SURFACE SOILS** caused by high volume foot and vehicular traffic is well known.
- **LESS WELL KNOWN** is the compaction of subsoils in newly constructed areas, which is caused by the inappropriate use of large machinery.
- **THE MECHANICAL CULTIVATION OF AN AREA**, without the incorporation of high humus materials, and its

subsequent destruction of the soil profile, can lead to compaction.

- **THE SEALING OF BARE SOIL SURFACE AREAS** by rainfall or irrigation frequently can lead to compaction problems.
- **THE CONSTRUCTION OF TURF AREAS** using materials of dissimilar particle size often leads to the settling of the smaller particles down through the soil profile, causing an area of compaction to develop. This settling of dissimilar soil particles to form a compaction layer—called a pan—is hastened in chronically saturated soils.

Chemical compaction can occur when soil chemistry is neglected. Soil chemistry degrades over time causing calcium, which normally creates a positively charged layer around the soil particles (flocculation), to be stripped away. This allows the remaining positively and negatively charged soil ions to bind together electro-magnetically. This electrochemical compaction can also occur in well managed, but saturated soils.

Various forms of layering make up the other large portion of the physical co-factor group. Layering, when it occurs near the soil surface, often presents an almost impenetrable barrier that limits the size of a plant's root system. Both decomposed and undecomposed thatch at the soil surface is the most common example of layering. There also can be layering between two divergent soil types, called a soil interface, such as that which occurs when sod grown in one soil type is laid on a different soil type. Soil interface problems also can occur when a thin layer of soil is added on top of an existing soil and the new soil is not mechanically mixed with the old. Multiple layering can occur when new soil is spread on top of soil that has a thatch layer or where the existing turf has not been removed.

Both compaction and layering pose an additional problem beyond the physical limitation of a plant's root structure.

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Compaction and layering frequently act as a hindrance to the normal downward percolation of water. When water is slow to drain through the root zone, the accompanying exclusion of oxygen and the build up of waste toxins can damage root structures.

The second group of strong co-factors consists of root damaging pathogens. In root zones that are saturated for prolonged periods, diseases like Pythium or Phytophthora can result, and, when combined with patch diseases, can produce devastating results. There have been some indications that the ever present Pythiums may play a significant role in the expression of patch disease symptoms. In some early research, testing how well various fungicides control patch diseases symptoms, the inclusion of specific pythium-attacking fungicides often produced positive results.

Moderate co-factors

MODERATE CO-FACTORS are a much broader group than strong co-factors. Their effects are often more subtle than those of strong co-factors. The moderate group includes such conditions as

- IMPROPER CULTURAL PRACTICES,
- THE FAILURE TO MONITOR AND CORRECT soil chemistry imbalances,
- THE IMPROPER USE OF FERTILIZERS, including timing and composition,
- THE FAILURE TO MAINTAIN A HIGH ENOUGH LEVEL OF FERTILITY—thereby affecting the host plant's ability to recover from damage,
- IMPROPER WATERING PRACTICES,
- IMPROPER DRAINAGE.

The list goes on and on.

Weak co-factors

WEAK CO-FACTORS REQUIRE either multiple layers of additional weak co-factors or, more often, the outside intervention of an additional force to produce patch diseases symptoms. These outside forces could be drought, high soil temperatures, dramatic change in a turf stand's environment, or insect attacks.

Which co-factors should be controlled?

DECIDING WHICH CO-FACTORS should be controlled and how much of an effect controlling a given co-factor will have on the ultimate production of obvious symptoms is difficult. First, more research still needs to be done on which co-factors have the greatest effect on which pathogens. Even when these relationships have been analyzed, the individual conditions at each infestation site will determine the order in which co-factors should be corrected or controlled.

In general, strong co-factors should receive immediate intervention:

- IF THE PROBLEM IS COMPACTION, then appropriate corrective measures, such as coring or aeration, should be initiated.
- IF THE PROBLEM IS LAYERING, then aeration and wetting agents should be used.

- IF THE PROBLEM IS PATHOGENIC, then cultural practices should be changed accordingly. If that proves ineffective, then fungicides should be used.

Moderate co-factors should be addressed in the normal flow of events. Recognizing their presence and designing corrective measures to be included in the normal maintenance of a site is usually effective.

Weak co-factors require the least intervention. Usually knowing that they exist and that their effects can be exaggerated by outside forces alerts you to keep an eye on them. Occasionally, a change in cultural practices can have a beneficial effect.

The bottomline

UNDERSTANDING WHAT CO-FACTORS ARE and the role that they play in the expression of patch disease symptoms will help turf professionals to accurately diagnosis and control patch diseases. Combining this awareness of co-factors with the ever increasing knowledge of the specific biology of individual patch disease pathogens should put turfgrass managers in a much better position to actually manage the dreaded patch diseases. ■

What do we mean by "patch disease"?

"PATCH DISEASE" is a loose field term that refers to a variety of late summer diseases characterized by large areas of damage. Previously, researchers gave a variety of names to this group, including Fusarium Roseum, Fusarium, Fusarium Blight and Fusarium Blight Syndrome.

Although the term still has not been defined precisely, current thinking includes in this group the pathogens that cause:

- NECROTIC RING SPOT—a problem on all cool season turf varieties except the bent grasses
- SUMMER PATCH—a problem on the blue-grasses, both perennial and annual, and the fine fescues
- TAKEALL PATCH—primarily a problem on bent grasses.

Although patch diseases can be a problem in low maintenance turf, they are predominantly a problem of high maintenance turf.

Because of the variability of the symptoms of these diseases and the fact that more than one pathogen may be present and active, a positive visual diagnosis can be very difficult. Laboratory culturing and microscopic examination are the only certain way to determine which specific pathogens are present, but that still may leave unanswered the question of which pathogen is actually causing the damage. ■