The Decline of Take-all Patch?

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During my short tenure here at the Turfgrass Diagnostic Lab, I have been repeatedly asked what our most frequently diagnosed problem on turf in Wisconsin is. From our home lawn samples, nearly half of the samples that are submitted come from recently sodded lawns that are severely infected with necrotic ring spot (*Ophiosphaerella korrae*). Due to the intense cultivation found on golf courses, there is a much wider array of diseases that are submitted. In most years, our most commonly diagnosed disease from golf course samples is take-all patch, caused by the fungus *Gaeumannomyces graminis* var. *avenae*.

As frustrating as take-all patch is for golf course superintendents to control, it is equally as frustrating for us at the TDL to diagnose. It is fairly well-known that take-all patch occurs most frequently on sand-based putting greens within the first ten years of construction. It has also been reported that the severity of the take-all patch decreases substantially in the first four years after construction (Landschoot *et al*, 1997). But we have observed weak take-all patch symptoms on courses older than most people reading this article, certainly well out of the range of the traditional take-all patch infection period. This past summer especially, courses that had not seen take-all patch for years saw nondescript bronzing and thinning of their bentgrass. When these samples were submitted to us, masses of black mycelium commonly found with take-all patch were found infecting the turfgrass roots and crowns. I'm sure more than one superintendent was surprised to hear when we diagnosed their samples as take-all patch.

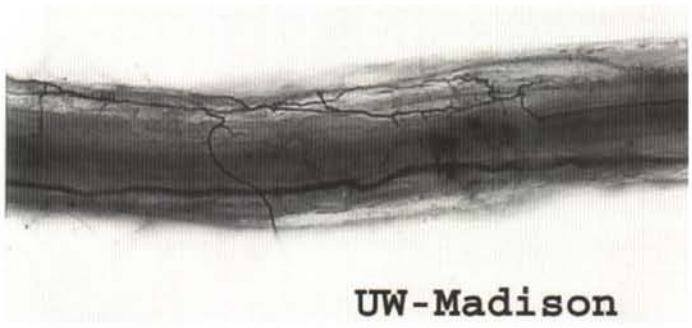

Figure 1. Take-all hyphae colonizing the surface of a creeping bentgrass root.

So what is happening underneath the soil surface to allow for such severe take-all infections immediately after construction? Why is that followed by decreasing take-all patch symptom severity for several years? Most confusing, why are we seeing take-all patch symptoms many years after the last symptoms have been observed?

The phenomenon of decreasing take-all severity has been observed in other continuously cropped systems, such as wheat, and has come to be known as take-all decline (Landschoot et al, 1997). The key to understanding the process of take-all decline is to understand the delicate balance of the soil microbiology in our golf course putting greens.

Let's start at the beginning, at the construction of a new sand-based putting green. The sand root zone used in putting green construction is usually fumigated to kill off any unwanted weed seeds, fungal pathogens, or insects. Unfortunately, this also kills off beneficial organisms that benefit the turfgrass plants in many ways (Unruh *et al*, 2002). Take-all patch is one of the first organisms that can migrate into this new root zone, and with potentially competing organisms killed in the fumigation, will be able to feed on the roots of the bentgrass with minimal competition.

Take-all patch can infect a new green through machinery such as mowers and core aerifiers (Landschoot *et al*, 1997). Once the fungus is present in the root zone, it will quickly colonize the surface of the roots with ectotrophic runner hyphae, periodically penetrating the root and eventually causing root death (Figure 1). With little competition from other organisms, the take-all fungus can quickly spread from root to root and cause severe take-all patch outbreaks (Landschoot *et al*, 1997). Chemical controls are usually needed to control take-all patch in this phase.

Over time though, other microbial organisms migrate into the root zone and increase the competition for the colonization of the root surface. *Phyalophora graminicola* is a common fungus that colonizes the surface of the root, but does not penetrate the root surface and hence is not pathogenic to the plant itself. Another organism that competes for colonization of the root surface is the bacteria *Pseudomonas*. Over time, both these organisms can out-compete the take-all fungus for space on the root surface, leaving the take-all hyphae to dry up and die. This process continues over the next several years, leading to the decreased severity of take-all patch (or take-all decline) observed in sand-based putting greens as they age (Dernoeden, 1997).

But we observed certain golf courses this past summer with moderate to severe take-all symptoms that were at least 10 years old, and much older than that in some cases. These symptoms are dependent on abnormal field conditions such as high soil pH or poor root health. High soil pH will lower the populations of organisms antagonistic to take-all patch dramatically, allowing the take-all fungus more room to colonize the surface of the root (Dernoeden, 1997). Factors leading to poor root health such as shade, compaction, poor drainage, or intense heat will lead to increased expression of take-all patch symptoms due to the lack of overall roots in the root zone (Jackson, 1997). If you have an increased size and increased number of roots in your root zone, your turfgrass will be better able to cope with the loss of a small per-

centage to take-all infection than a poor root system.

The high number of take-all patch symptoms observed this past summer was most likely due to decreased root systems brought about by extremely stressful weather conditions. These stressed root systems were unable to cope with small levels of take-all infection, causing disease symptoms where in most years there would be none. In an average summer, with less stressful growing conditions, the turfgrass plant will be able to handle small levels of take-all infection.

There have been attempts to apply organic topdressing material to increase *Phialophora* and *Pseudomonas* populations in the soil, but these have been only moderately successful in controlling take-all patch and can lead to other problems such as decreased drainage (Dernoeden, 1997).

We currently have two take-all patch studies in progress. One study is at the OJ Noer Turfgrass Research and Education Facility, and it is an intensive look at controlling take-all patch on inoculated plots with fungicides, fertilizers, and a combination of both. The other is a fungicide trial at a Wisconsin golf course that experienced a rather severe take-all outbreak in the stress-filled summer of 2005. The results of both studies will be available this upcoming summer, so please feel free to contact Dr. Jung or myself on the outcome of either study.

References

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