

## Preventative Control of Fairy Ring

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The first disease described on cultivated turf was fairy ring. W. Faulke wrote an essay in 1563 entitled, "A goodly Gallerye with a most pleasant Prospect, into the garden of naturall contemplation, to behold the naturall causes of all kynde of Meteors, that first described fairy rings as "those round circles that ignorant people affirm to be the rings of the Fairies dances". Today we know that fairy ring is caused by many different species of basidiomycete fungi, but imagine how much simpler life would be if a fairy did cause fairy ring. Oh how nice it would be to say "I don't believe in fairies!!" and have our fairy ring problem disappear instantaneously. I know it sounds cruel to end poor Tinkerbell's life, but lets face it fairy rings have become a major issue for golf course superintendents.

The first question that always pops into my mind is, Why? Why has fairy ring become an emerging problem for golf course superintendents? I think the main reason is we have switched from very non-specific fungicides to more specific fungicides. I suspect the fungal populations of turf systems treated with lead-, mercury- and cadmium-based fungicides were not too happy. Another reason may be the dominance of sandbased root zones for putting greens. We do not know a whole lot about the biology of fairy ring fungi, but we do know that they are primary colonizers of substrates. Therefore in a relatively inert rootzone such as sand, these fungi likely move in first.

We also know that fairy ring fungi are ubiquitous soilborne organisms that are everywhere. They are waiting for the opportunity to thrive on an organic matter source. Spores of fairy ring fungi are airborne as well, so they can travel great distances on air currents. Therefore sterilization of soil may effectively limit fairy ring development initially; yet overtime the fungi will establish themselves in the ecosystem. Fungi that cause fairy ring have been around for a long time and have caused disease on turf swards for many years. Like many of our diseases in turf, we know very little about the biology, epidemiology and management of fairy ring. However, some nice work on the biology and preventative control of fairy ring has emerged from North Carolina. Plus we conducted a small preventative fairy ring trial that showed promising results.

## **Biology**

Fairy ring can be incited by 60 different species of basidiomycete fungi. However, the crew at NC State has collected over 200 isolates of fairy ring from all over the country and has narrowed the species list down to four or five. That's not to say that others cannot cause fairy ring, but from putting greens there seems to be four or five prominent species. They have identified the isolates based on morphological characteristics (Figures 1 and 2) and molecular characteristics. Eighty-eight percent of the isolates they have collected (which includes isolates we sent them from Wisconsin) were identified as *Vasecellum curtisii* or *Bovista dermoxantha*. Both of these species are puffball fungi and these seem to be the predominate species inhabiting putting greens.

A question that arose at the International Turfgrass Conference was, "Is fairy ring a disease?" A disease is defined as an abnormality in structure or function of a plant caused by the constant irritation of a microbial agent that results in the production of symptoms. I would say that fairy ring meets that definition to the letter! Then the question remains, "are fairy ring fungi pathogens?" Yes they are because pathogens are microorganisms that cause disease and we have already established that fairy ring is a disease.



Figure 1. Hyphae of a fairy ring fungus. The small bump on the centermost hypha is a clamp connection, a key diagnostic feature of fairy ring fungi.



Figure 2. Close-up of a puffball collected by Lee Miller at North Carolina State University.



Figure 3. Type I fairy ring symptoms. Note the necrotic rings surrounded by dark green tissue.

## WISCONSIN PATHOLOGY REPORT

When it comes to terminology I am a hard-liner. Plant diseases cannot be caused by abiotic factors, in other words I subscribe to the philosophy that there is no such thing as an abiotic disease. Yet there are a few cases when a pathogen causes a disease without actually infecting the plant. Of course fairy ring is one of those diseases. Another classic example is sooty mold. This particular fungus lives on aphid excrement, but can cause damage to plants by profusely colonizing the leaves that severely limits photosynthesis. Essentially my point is fairy ring is a disease, eventhough the causal agents may not infect the plant.

So what causes the symptoms we see? First there are three types of fairy ring symptoms- Type I, Type II and Type III. Type I are when the rings become necrotic, type II symptoms are the luxuriant green growth of the outer ring and type III is just a ring of mushrooms or puffballs (Figures 3, 4). Fairy ring fungi are happy inhabitants of soil organic matter, so type II symptoms are likely the result of luxuriant growth of the turf due to the liberation of nitrogen from the organic matter. As the fungal body expands, the old tissue dies coating the soil particles with a hydrophobic substance. The necrotic rings develop once the environment becomes dry enough to kill the turfgrass plant. This is a diagnostic feature of fairy ring, as the thatch layer or upper 1 inch of soil is orange (Figure 5). We rarely see mushrooms or puffballs on putting greens because they are mowed daily. The mower is a deadly enemy of mushrooms and puffballs, which is the likely reason we have been in the dark about fairy ring populations for so long. The biology of fairy ring fungi is important to keep in mind when thinking about fairy ring management.

## **Management:**

Fairy ring management can be accomplished preventatively or curatively. However, usually the best medicine for any plant disease is preventative treatments.

Research at NC State, The Chicago District Golf Association, Penn State and most recently UW-Madison have demonstrated that preventative applications of fungicides targeting fairy ring should be applied when soil temperatures are between 55 and 65oF. The fungicides that have proven effective are: triticonazole, metconazole, triadimefon, pyraclostrobin, azoxystrobin and fluoxastrobin (Figure 6). The current recommendations are to make the first application when soil temperature reach 55o-F and follow that application up 28 days later with another application. Each application should be irrigated with 1/8 to 1/4 inch of water. Preventative applications **should not** be tank-mixed with wetting agents!

The beauty of this program is, most of these chemicals are known to be effective against take-all patch. The timing of applications for take-all patch is similar too. Under severe fairy ring outbreaks preventative control may only be achieved with more applications. For example, most preventative fairy ring programs start and end in the spring, but for severe cases applications in the spring and fall may be necessary. Along with preventative fungicide applications, an aggressive topdressing and aerification program should be followed. We know that fairy ring fungi thrive in organic matter or thatch therefore it is imperative that we limit thatch production. It is also recommended that wetting agents be periodically applied during the summer months.

For curative applications, flutolanil (ProStar®) is really the only fungicide that is recommended. During application the chemical should be mixed with a wetting agent. Efficacy may also improve if applied after spiking the putting surface. Fighting fairy ring curatively is a constant battle because of the shear amount of the fungus in the soil. Typically the residual activity of flutolanil against fairy ring is 14 to 21 days, so applications will need to continue on a regular interval during optimal conditions. Yet the problem with the aforementioned statement is, we do not know what the optimal conditions for fairy ring development are!

As far as cultural control is concerned, type II symptoms can be masked with nitrogen or iron applications. Aerification and spiking disrupts the fungal body, which can slow the development of the disease. Minor infestations may be kept at bay with cultural practices, but without chemical intervention the problem could become more severe. Basically, these cultural practices should be coupled with a strong preventative control program to achieve season-long fairy ring control.



Figure 4. Type II fairy ring symptom, a ring of luxuriant green growth.



Figure 5. Mycelia mat of fairy ring fungi after incubation. Notice the orange color of the thatch layer and the plants where the fungus is. Anyone see the little mushroom popping out of the side of the sample?



Figure 6. Plot from our preventative fairy ring trial in 2009. This particular plot was treated with Disarm G (fluoxastrobin). Applications were made when soil temperatures approached 55°F and were repeated approximately one month later. Note the dark green area at the top of the picture in the adjoining plots. This indicates that fluoxastrobin may be effective against fairy ring, but we need more data to confirm this.