

RESEARCH UPDATE

Over the years there have been many attempts to control fairy rings on golf courses by applying fungicides. Although fungicides can suppress fairy rings for a time, eradication or complete control is difficult to achieve. Research at the STRI, sponsored by the Royal and Ancient Golf Club of St.

Andrews, has been exploring new approaches to fairy ring elimination in which biological control techniques rather than fungicides are deployed. In this article, the most promising findings of this research are outlined and the potential of biological control discussed.

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THE lush green grass rings or circles of mushrooms formed by fairy rings occur extensively on many golf courses in the UK and consequently they are easily recognised by most greenkeepers. Many first impressions are that as they occur on less intensively managed areas, such as fairways and in the rough, they do not cause appreciable damage and are consequently of little concern.

However, these first impressions can soon turn to dismay as extensive fairy ring development can cause significant damage, particularly so when they occur on tees, approaches to greens, aprons or even the greens themselves.

Biological control mechanisms, developed by plant pathologists at the STRI and universities in the USA and Canada, offer an alternative to fungicides for control of fairy rings.

By definition, biological control is the use of natural enemies to control disease. Natural enemies, in the context of turfgrass diseases, can basically be divided into two groups.

Firstly, in turf there are fungi termed hyperparasites, which attack the disease directly. Thus, in the same way that fusarium patch is harmful to turf grasses, these hyperparasites are directly harmful to the disease. Biological control based on hyperparasitism has been well developed for several diseases of agricultural and horticultural crops but, as yet,



Turf infected with fairy rings mixed with the underlying soil by use of a rotivator.

it has not been thoroughly investigated for turf diseases. Great potential for future turf disease control lies in this area.

Secondly, biological control based on another phenomenon termed antagonism has been developed for several turf diseases and in particular for fairy rings. Antagonism is a relationship between different organisms where one (the antagonist) partly or com-

pletely inhibits the growth of another (the fairy ring).

Observation on the development of Type One fairy rings (*Marasmius Oreades*) has revealed some very interesting information.

For example, it is rare to find one ring developing inside another larger ring. Also, surveys of *M. oreades* rings on lawns have indicated that fairy rings are most numerous on lawns six to ten years old, and there is a decline in the number of rings with increasing lawn age. Finally, when two rings collide, in the zone of collision the rings cancel each other out to form a figure of eight arrangement.

This observation can be repeated under laboratory conditions. If cultures of *M. oreades* are allowed to grow towards each other on a Petri dish then both cultures will stop shortly before they are due to come into contact.

These observations have led to the conclusion that fairy rings are discouraged from spreading by a naturally occurring biological control exerted by antagonistic fungi and bacteria in the soil.

The observation that one ring rarely develops inside another is explained, at least partly, by the build up of antagonists that directly inhibit any subsequent rings. Older lawns, which appear to be less prone to fairy rings, have had time to develop an antagonistic soil microflora.



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However, a separate theory has been suggested to explain the mutual decline of fairy rings when they collide. It appears that the fairy ring mycelium can be antagonistic to itself. This phenomenon is known as mutual antagonism and is thought to be due possibly to competition for nutrients and/or inhibitory substances produced by the fairy ring mycelium.

How can we use this antagonism between fairy rings, soil fungi, and bacteria and mutual antagonism within *M. oryzae* itself to develop an effective control method?

Well, two different avenues of



Type One fairy rings

research have been followed. One particular soil fungus, namely *Trichoderma harzianum* has been shown under laboratory conditions to be highly antagonistic to fairy rings.

Cultures of *T. harzianum* have

been applied to fairy rings down hollow tine holes. In this way the natural antagonisms of the soil can be given a boost, to the detriment of the fairy ring. Suppression of fruiting body production of *M. oryzae* has been achieved using this technique but it is too early to say whether a long term control measure has been found.

PROMISING

Another method of boosting antagonisms of fairy rings has been developed that shows considerable promise. Turf infected with fairy rings is thoroughly cultivated and mixed with the underlying soil using a rotorvator. This produces many fragments of fairy ring mycelium which will be mutually antagonistic and will also expose the fairy ring fungus to the antagonistic effects of the microflora of the soil.

Obviously, this technique has only been developed for use on fairways and other less-intensively managed turf areas. Fairy rings treated in this manner have not reappeared for five years.



Above left:
figure of eight
arrangement formed when two
rings collide.

Left:
hollow tining rings to assist
application of antagonists.