FAIRY RINGS AND THEIR CONTROL IN TURF AREAS

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Turf diseases known as fairy rings may be caused by any one of 60 species of fungi. These fungi can cause the formation of rings or arcs of dead or thinned turf, or rings of dark green, luxuriant grass. Fairy ring fungi belong to a group known as the Basidiomycetes or "mushroom fungi." These fungi primarily colonize thatch or organic matter in soil and generally do not parasitize or directly attack turfgrass plants.

There are three types of fairy rings, which are grouped according to their effects upon turf:

Type 1: Those that kill the grass or badly damage it.

Type 2: Those that stimulate grass and cause formation of rings of dark green turf

Type 3: Those that do not stimulate grass and cause no damage, but produce mushrooms or puffballs in rings.

The most destructive rings are Type 1, which are very common in all turfs including home lawns, and golf course fairways that had been a pasture, or where tree stumps or lumber had been buried. They also are common in sand-based rootzones of putting greens and tees. Type 1 rings initially appear as circles or arcs of dark green, fast growing grass.

The most common fungi known to cause Type 1 fairy rings include *Agaricus* spp., *Lycoperdon* spp. and *Marasmius oreades.* Type 1 rings are distinguished by three distinct zones: an inner lush zone where the grass is stimulated and grows luxuriantly; a middle zone where the grass may be wilted or dead; and an outer zone in which the grass is stimulated.

The distance from the inner zone to the outer zone may range from a few inches to two feet wide. The breakdown of organic matter along the periphery of advancing rings or arcs results in the liberation of nitrogen. As nitrogen becomes available to the grass, it causes the growth stimulation.

Type 1 fairy rings on a tee.

Green stimulated Type 2 fairy ring in a fairway.

KEY POINTS

Fairy rings are caused by fungi, which grow mostly in soil and thatch.

Rings may vary in size from a few inches to 200 feet in diameter.

Type 1 fairy rings make the soil hydrophobic, which causes drought stress, thinning, and death of turf.

There are three ways to manage fairy rings: suppression, antagonism, and eradication, but only suppression is practical.

The outer green zone is probably caused by the breakdown of organic matter in thatch by the fairy ring fungus, while the inner green zone is likely caused by the release of nitrogen as bacteria degrade the mycelium of aging or dead fungus. The formation of the three zones are noticeable from early spring to winter.

Mushrooms or puffballs of the fungus causing a Type 1 ring generally are produced at the junction of the bare and outer zone. Rings, however, may not produce mushrooms for several years, especially on closely cut putting greens.

The underside of the mushroom cap is composed of gills, upon which spores are produced. The importance of spores in the spread of fairy rings is not well understood. Puffballs are egg-shaped and spores are produced inside the fruiting body. Attempts to transmit the disease with spores and even plugs of soil taken from active rings have failed.

The ring is broken when the mycelium encounters an obstacle such as a rock, pathway, or unfavorable soil condition. The ring also may disappear for no apparent reason. In general, two fairy rings will not cross one another, i.e. at the point of intersection the growth of each ring stops. This obliteration at the point of contact is believed to be caused by the production of self inhibitory metabolites that also will antagonize other members of the same or different fungal species.

On slopes, the bottom of the ring is usually open, giving the appearance of an arc rather than a ring. Once again, it is believed that inhibitory metabolites leach downward on slopes and prevent fungal development into the turf on the lower side of the ring.

Rings may vary in size from a few inches to 200 feet in diameter or more, becoming larger each year. The annual radial growth ranges from 3 inches to as much as 19 inches. The rate of outward movement as well as overall diameter of rings is determined by soil and weather conditions.

Growth of fairy rings begins primarily from the transport of fungal fragments (i.e. mycelium). Theoretically spores also provide a means for ring fungi to disperse. The fungus initiates growth at a central point and continues outward in all directions equally.

The fairy ring generally is first observed as a cluster of mushrooms. Rings fade in the autumn or winter. Symptom decline is due to the general brownish appearance of dormant turf during winter and because the turf is not metabolizing nitrogen in large enough quantities during winter to produce the lush green zones characteristic of fairy rings.

Fairy rings have been observed in areas where soil pH has ranged from 5.1 -7.9. It is likely, however, that fairy rings will occur under any soil condition that also will support turfgrass growth. All of the commonly cultivated turfgrass species are known to be affected by fairy ring fungi.

It was first suggested in 1917 that fairy rings killed vegetation by rendering infested soil impermeable to water. Hence, the dead zone is due to the mycelium of the fungus that accumulates in such large amounts in soil that it prevents entry of rain or irrigation water, and thus kills the plants by drought. Furthermore, many other authorities have noted that soil in the dead zone is always dry compared to soil adjacent to the dead zone.

When environmental conditions are optimum for fungal growth, the white mycelium may be seen on the surface of the thatch layer. Although fairy ring fungi are known to parasitize roots and produce compounds toxic to roots, it is likely that most damage to turf can be attributed to the fungal mycelium, which renders the soil impermeable to water.

It is quite characteristic for grass on the outer edge of the dead zone to display the blue-gray color of turf under drought stress. Generally, if a plug of soil is removed from the edge of an active fairy ring it will have a mushroom odor. Sometimes the white, thread-like network of mycelium can be seen clinging to soil and to roots of grass plants.

Control of fairy rings is made extremely difficult due to the hydrophobic nature of the infested soil. Chemical control is difficult because the fungus grows deeply into the soil and lethal concentrations of fungicide do not

come into contact with the entire fungal body.

There are three approaches to combating fairy rings: (a) suppression, (b) antagonism, and (c) eradication.

SUPPRESSION

Suppression is the most practical approach to combating fairy rings in most situations. The suppression approach is based upon the premise that fairy rings are less conspicuous and less numerous where turf is well watered and fertilized.

This method of control involves a combination of core aeration, deep watering and proper fertilization. Coring is beneficial as it aids in the penetration of air and water. The entire area occupied by the ring, to include a 2 foot periphery beyond the ring, should undergo coring or be plugged on 2 to 4 inch centers. The area should then be irrigated to a depth of 4 to 6 inches. Use of a soil wetting agent should help improve water infiltration.

Drenching with a fungicide such as Bayleton (triadimefon), Tourney (metconazole),ProStar (flutalonil), Heritage (azoxystrobin) or Polyoxin D (Affirm or Endorse) may help to suppress some fairy ring fungi. Tank-mix fungicide with a soil wetting agent to improve penetration. Tank-mixing Bayleton with Prostar may improve results. See TT-38 “Maryland Turfgrass Disease Control Recommendations” for more information on fungicide selection and rates. Fungicides, however, do not eliminate these fungi and may have to be reapplied on a 3 to 4 week interval.

The ring area should be re-treated in a similar fashion at the earliest indication of drought stress; that is, repeat the process whenever the dark green grass turns blue-gray and begins to wilt. When a core aerator is not available, a deep root feeder with garden hose attachment may be useful to force water into the dry soil. About 1.0 to 2.0 lb N/1000ft^2 should be applied to cool-season turf in 1 to 2 applications during autumn to help mask fairy rings. Fairy rings, however, can be stimulated by excessive amounts of nitrogen or organic matter.

ANTAGONISM

The antagonism approach is based upon the observation that rings exhibit mutual antagonism, i.e. elimination when they come into contact with one another.

This method involves removal of the sod by striping or killing the turf with a nonselective herbicide. The soil or the soil plus dead turf should be roto-tilled repeatedly in several directions until the mycelium-infested soil has been thoroughly mixed. The soil should then be prepared in the usual manner prior to seeding or sodding.

This method has been shown to be very promising, but has had only limited testing. In Canada, lawns heavily infested with fairy rings have been tilled using the method previously described, and have not shown evidence of new rings over an eight year period. In Maryland, however, fairy rings are known to recur in sod fields within 2 to 3 years after harvest and establishment of a new crop.

ERADICATION

There are two methods of eradication: fumigation and excavation. Both methods are laborious, costly and not always successful. Fumigation is impractical and should only be performed by a licensed pesticide applicator.

The second alternative to fairy ring eradication is to carefully dig out and discard all infested soil in the ring. This would involve removal of soil to a 12 inch depth, and the excavation should be wide enough to extend at least two feet beyond the outermost evidence of the ring. The excavation must then be filled with fresh, uncontaminated soil, and then the area should be reseeded or sodded.