



FAIRY RINGS, MUSHROOMS, AND PUFFBALLS

Symptoms

Fairy rings can appear in any turfgrasses during the spring and early summer as circles, arcs, or ribbons of darker green, fast growing grass. A concentric ring of thin, dormant, or dead grass may sometimes develop both inside and outside this circle. Occasionally, a second zone of stimulated grass occurs inside the zone of dead grass (Figure 2). During dry weather, especially in the late summer and fall, the outer ring of lush grass may be missing. Fairy rings vary from a few inches to 50 feet or more in diameter, but most are 2 to 15 feet across. In mild weather, after rains or heavy sprinkling, large numbers of mushrooms or puffballs (the fruiting bodies of the fairy ring fungi) may suddenly pop up in the outer circle of lush grass (Figure 1). Commonly, several distinct rings or arcs develop in the same general area. Where the rings meet, fungus activity ceases, and the rings take on a scalloped effect (Figure 3).



Figure 1. Mushrooms in a fairy ring.

Generally, fairy rings are first seen as a cluster of mushrooms or as a tuft of stimulated turf. The rings may grow outwardly for years or be disrupted when intercepted by a driveway, building foundation, or flower bed. Some rings disappear unexpectedly for a year or more and then reappear, usually a foot or more, larger in diameter.

Cause

The disease is caused by any one of about 50 soil-inhabiting fungi (mushrooms [toadstools] and puffballs), the most common being the small, tan fairy ring fungus, *Marasmius oreades*. *Agaricus (Psalliota) campestris* or *A. bisporus*, the cultivated mushroom, will also cause fairy rings. Both of these fungi are nonpoisonous, however, **do not eat** any mushrooms growing in turf areas without first having them identified by a competent authority. The immature stages of *Agaricus* are indistinguishable from the large, white, poisonous *Chlorophyllum molybdites (Leptiota morgani)*; see Figure 4. Only at maturity can these two mushrooms be identified accurately. Even when identified as edible, a mushroom

For further information on Turfgrass Diseases contact Nancy R. Pataky, Director of the Plant Clinic and Turf and Ornamental Specialist, Department of Crop Sciences, University of Illinois, Urbana-Champaign.

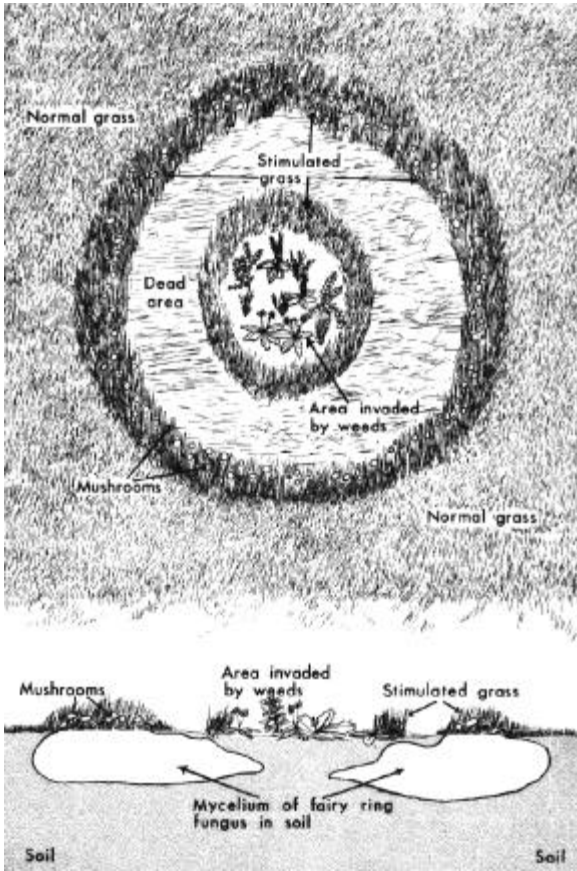


Figure 2. Top view and cross section of fairy ring with rings of stimulated grass with mushrooms, weak or dead grass, mycelium of fairy ring fungus in soil, and central area invaded by weeds. Drawing: Lenore Gray

soil, depletes nutrients essential for plant growth, and may produce toxic levels of ammonia or hydrogen cyanide, as is suspected of *M. oreades*. The grass in this area can become so weakened that it succumbs to environmental stresses or the grass roots are killed by the fungus as other disease organisms. Invasion by weeds soon follows. As the fungus grows outward radially, the older spawn in the interior of the ring dies, releasing nitrogen and other nutrients for use by the grass plants, initiating the possible formation of the inner green ring of stimulated grass (Figures 2 and 3). If this lush growth persists into the autumn, the chances of *Microdochium nivale* (pink snow mold) infection increase. Fairy rings are usually most severe in light-textured, low-fertility soils that are low in moisture. The rings are more common and damaging on lightly watered and fertilized golf fairways and lawns than on well-irrigated and fertilized golf greens, tees, and lawns. Turf with a thick thatch and growing in a sandy soil is very vulnerable to damage, especially in drier regions.

Control

Controlling fairy rings is not easy because the soil becomes almost impervious to water. Before planting a new turf area, remove tree stumps and large roots, construction lumber, and other large pieces of organic matter from which these fungi obtain nutrients. Keep the new

may not be entirely safe. Some individuals may have allergic reactions, while others can become ill if wine or other alcoholic drinks are also consumed. Since children are the largest group of fatalities associated with mushroom poisoning, it is best to dispose of the mushrooms as they appear.

Disease Cycle

Nutrients for these fungi come from the breakdown of organic matter. Infection often begins where large roots or lumber are buried in the soil. Growth usually starts with a germinating fungal spore or with pieces of mycelium at a central point and continues radially in all directions. Each year the rings may enlarge from 5 inches to 2 feet or more. The fungus grows throughout the soil, sometimes to a depth of 8 inches or more. If you dig deeply into the ring area with a trowel or spade, you will find a dense, white, threadlike network of mycelium (mushroom spawn) that has a strong musty odor.

The lush, dark green grass of the fairy ring is due to the increased amount of nitrogen made available to the grass roots by the fungus as it breaks down organic matter in the thatch and soil. The ring of brown, dormant or dead grass is caused by the dense, subsurface layer of mushroom spawn that impedes water movement into the



Figure 3. Antagonism between fairy ring fungi. Not living grass where rings intersect.

planting well fertilized, and watered to a depth of 6 inches or more. Shallow watering encourages the germination of many fairy ring fungi. In established turf area, fairy rings can be effectively controlled by three laborious and time-consuming methods: suppression, eradication, and antagonism.

A. **Suppression.** To suppress ring formation, water the turf thoroughly and fertilize well to enhance the growth of grass within and around rings to a level close to that of the lush ring of grass.

1. The symptoms are easily disguised by pumping large quantities of water into the soil, 10 to 24 inches deep, at one-foot intervals, for a distance of 18 to 24 inches on either side of the stimulated zone of dark green grass. Maintain the soil in a near water-soaked condition for 4 to 6 weeks by watering every 2 to 3 days. Use a tree-feeding lance or root-feeder attachment on a garden hose. Repeat the treatment, several months to a year or more later, when the rings begin to wilt. (This is the easiest and cheapest method of suppression).
2. Since there are fewer rings and they are much less conspicuous on adequately watered and fertilized turf, apply nitrogen fertilizer to the turf several times during the year. Follow local recommendations based on a soil test and the cultivar or blend of grass being grown. Avoid excessive applications of nitrogen and organic matter (manure or mulches) as they tend to stimulate the development of fairy rings and encourage other turf diseases. Core cultivation and use of wetting agents (surfactants) helps water to move more deeply in infested soil.

B. **Eradication.** Fairy rings can be eradicated by soil fumigation or excavation. Drenching with a fungicide has met with only moderate success.

1. **Fumigation.** Carefully strip and dispose of the sod in an area 2 feet inside and 2 feet outside the outer green ring of grass. Be careful not to spill any of the infested soil or sod on the healthy turf. A better but more expensive method is to apply glyphosate (Roundup, Kleenup) to the area. This will kill the grass in about a week with little or no chemical residue remaining to affect the new planting, however, you will still have to dispose of the dead turf after using glyphosate because it may still contain living mycelium of the fairy ring fungus. Loosen the soil underneath to a depth of 6 to 9 inches with a spading fork or by rototilling, to improve the results. Have the soil fumigated by a certified golf course superintendent or turfgrass specialist who is licensed to handle and apply restricted use pesticides.

The soil temperature should be 60°F (16°C) or above for fumigation. The vapors of the fumigant are kept in the soil by carefully covering the stripped areas with a gas-proof plastic cover for 7 to 10 days depending on the fumigant used. The plastic cover is removed after the fumigation period. After removing the cover, the soil should be stirred and left exposed to the air for 2 weeks or until all odor of the chemical has disappeared. Fresh soil should be added to the area as needed, followed by seeding or sodding.

2. **Excavation.** Carefully dig out and haul away at a safe distance from turf all infested soil in the ring (12 inches or more deep and extending 2 feet on either side of the outer stimulated zone, including all mushroom spawn) and replace soil in the trench with fresh, clean (preferably sterilized) topsoil that is free of fairy ring fungi. The area is then sodded or reseeded. This method is generally impractical and too expensive in most situations.

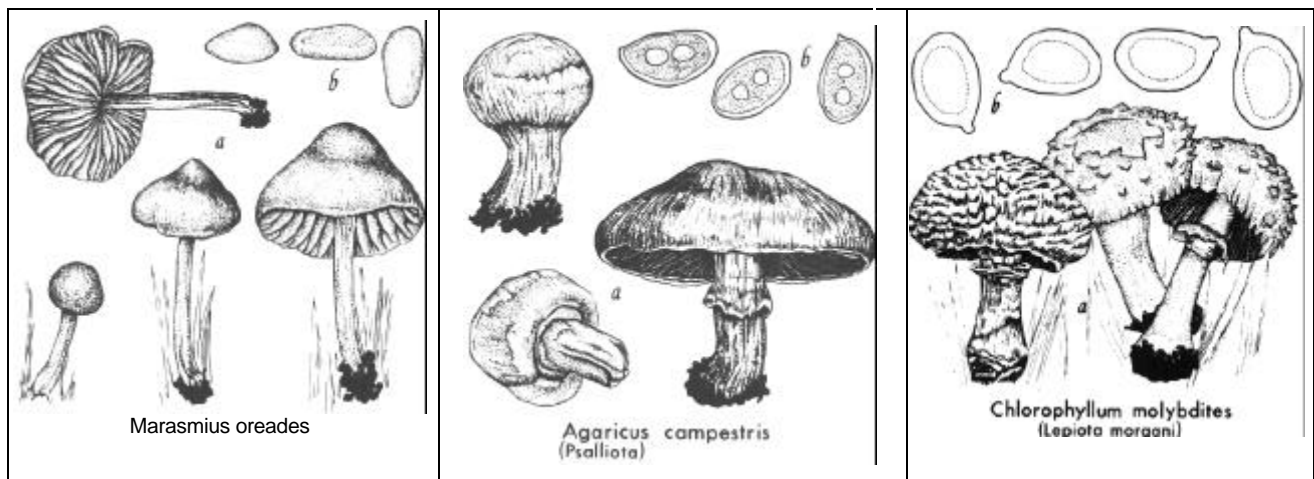
C. **Antagonism.** Antagonism is most effective when a turf area is heavily infested with a number of fairy rings. The biology of these fungi, for example, *M. oreades*, will ensure that two or more strains will eliminate each other when occupying the same site. Figure 3 shows how antagonism has stopped disease development where two fairy rings meet. This method of control, while requiring the same initial steps that are used for eradication, is much cheaper because the costs for chemical fumigants and for a licensed applicator are eliminated. Also, there is no danger of injury from contact or inhaling chemical fumes.

1. After killing the infested area with glyphosate and stripping the sod, thoroughly rototill the entire area covered by the fairy rings. Using a rake, collect the white mycelial spawn from several rings and blend it thoroughly. Spread the blended spawn as evenly as possible over the exposed soil, then mix the mycelium-infested soil by multiple cultivations with a rotary cultivator to a depth of 6 to 8 inches in several directions to effectively mix the spawn of the fungi. Rake or roll the soil level and fertilize.
2. Wet the soil to a depth of 8 inches or more with or without adding a wetting agent to increase water infiltration into the denser spawn layers. Keep the soil bare for several weeks (or more), such as through winter, then sod or reseed the area, and keep it well watered and fertilized.

MUSHROOMS AND PUFFBALLS

A large number of species of fungi that produce mushrooms (toadstools) and puffballs feed on decaying organic matter in the soil. These fungi, including those that produce fairy rings, are most common around dead and buried stumps, roots, boards, or excess thatch. The spore-producing mushrooms and puffballs, which are 1 to 12 inches in diameter, appear after heavy rains or watering (Figure 7). Some mushrooms

Figure 4. Fairy ring fungi: Left, Mushrooms of *Marasmius oreades*, *Agaricus*



(*Psalliota*) *campestris*, and *Chlorophyllum molybdites* (*Lepiota morgani*); b) Basidiospores as seen under microscope.

and puffballs are foul-smelling; a few are poisonous. These nuisance fungi overwinter as mycelial spawn in the soil and in decaying organic matter. The fruiting bodies produce large numbers of microscopic spores (basidiospores; see Figure 5) that are spread by air currents, water, turfgrass equipment, and tools of all kinds.

The control for mushrooms and puffballs, where practical, is to carefully dig up and destroy rotting stumps, roots, or other underground sources of organic debris. If you suspect the fungi of being poisonous to children or pets, break or mow off the fruiting bodies when first seen. Mushrooms and puffballs will disappear naturally only when the food base in the soil is exhausted. This process may take 10 years or more for a large stump or root.

The mention of a trade name or proprietary product does not constitute warranty of the product and does not imply approval of this material to the exclusion of comparable products that may be equally suitable. Always read and follow the current package label instructions and precautions.