Combination Treatments for Fairy Ring Prove Effective

By Mike Fidanza

Wilted or necrotic turfgrass associated with type I fairy ring is the direct result of the basidiomycete fungus colonizing in soil organic matter. Affected areas can become water-repellent, causing severe drought stress and turf injury. Treating the symptoms and the cause is often the best approach.

Fairy ring refers to circles of mushrooms or rapidly growing, lush-green circular bands of grass observed in established turf areas (Couch, 1995; Shantz and Piemeisel, 1917). Fairy ring occurs worldwide in all cultivated turfgrasses and is frequently observed on greens, fairways, tees and roughs (Fidanza et al., 2000). Fairy ring symptoms have been observed in areas where soil pH ranged from about five to eight and is attributed to over 50 species of soil inhabiting basidiomycete or "mushroom" fungi (Couch, 1995; Smiley et al., 1992; Smith et al., 1989; Vargas, 1994; Watschke et al., 1995).

In turfgrass ecosystems, the fungal mycelium primarily colonize the thatch and organic matter components in soil and typically does not directly infect turfgrass roots and shoots. As a result, above ground symptoms in turfgrass can include dead or wilted or damaged turf, dark, lush-green growing grass or the formation of mushrooms. Fairy ring symptoms in turfgrass are classified into three distinct groups: type I, type II or type III.

Couch (1995) further describes fairy ring as either lectophillic or edaphic. Lectophillic fairy ring refers to symptoms produced by fungi that primarily colonize the thatch and mat, while edaphic fairy rings are attributed to symptoms produced by fungi that primarily inhabit the soil. Both lectophillic and edaphic fairy rings can develop all three symptom types.

Type I fairy ring and localized dry spot

Fairy ring symptoms in turf are often ignored in hopes that they will go away. In many cases, symptoms seem to disappear, but actually they are masked by healthy, vigorously growing turfgrass. On golf courses, fairy ring symptoms can persist and become a visual nuisance. Among all three symptom groups, type I fairy rings are the most destructive in turfgrass and especially on putting greens. Fairy ring fungi decompose organic matter and contribute to organic coatings on sand and soil particles, and mycelium can prevent the movement and root uptake of water

TABLE 1

Test for soil water repellency from the type I fairy ring site

	Soil sampling depth				
	0 cm	1 cm	2 cm	3 cm	4 cm
Location within symptom area[1]	seconds[2]				
outside area	6.8 b[3]	4.2 b	1.0 a	1.0 a	1.0 a
ring area	239.2 a	63.8 a	1.4 a	1.0 a	1.0 a

[1] Soil cores removed from outside the affected ring area and from within the actual ring area.

[2] Soil water repellency was determined from the water drop penetration test (King, 1981; Kostka et al., 1997). Five soil cores were removed at random from each area on Aug. 2, 2002. Soil cores were allowed to air dry on a laboratory benchtop for two weeks. Afterward, a single drop of water (approximately 35 micrograms per liter) was placed at 0 (thatch/soil interface), 1, 2, 3 and 4 cm increments to determine the amount of time required for the water drop to penetrate into the soil core. Time of < 5 seconds indicates non-water repellent, 5 to 60 seconds is moderate, 60 to 300 seconds is severe, and > 300 seconds indicates extremely water repellent soil.

[3] Analysis of variance determined with Statistical Analysis Software (SAS, 1985). Data are means of five replications and means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's protected least significant different test.

TABLE 2

Test for soil water repellency from the type I fairy ring site

Location within symptom area[1]	Soil sampling depth				
	0 cm	1 cm	2 cm	3 cm	4 cm
	seconds[2]				
outside area	46.5 b[3]	6.7 a	4.5 a	2.3 a	1.5 a
ring area	155.3 a	19.5 a	9.0 a	4.8 a	3.0 a
inside area	58.2 b	13.3 b	3.5 a	1.5 a	2.5 a

[1] Soil cores removed from outside the affected ring area and from within the actual ring area.

[2] Soil water repellency was determined from the water drop penetration test (King, 1981; Kostka et al., 1997). Five soil cores were removed at random from each area on Aug. 14, 2002. Soil cores were allowed to air dry on a laboratory benchtop for two weeks. Afterward, a single drop of water (approximately 35 micrograms per liter) was placed at 0 (thatch/soil interface), 1, 2, 3, and 4 cm increments to determine the amount of time required for the water drop to penetrate into the soil core. Time of < 5 seconds indicates nonwater repellent, 5 to 60 seconds is moderate, 60 to 300 seconds is severe, and > 300 seconds indicates extremely water repellent soil.

[3] Analysis of variance determined with Statistical Analysis Software (SAS, 1985). Data are means of five replications and means in a column followed by the same letter are not significantly different at $P \leq 0.05$ according to Fisher's protected least significant different test.

in soil (Couch, 1995). The result is drought-stressed and wilted turfgrass due to hydrophobic or water-repellent soil.

There is often a misunderstanding between fairy ring and localized dry spot (LDS). While water-repellent soil is a condition associated with type I fairy ring, not every LDS situation is caused by fairy ring fungi. Researchers currently agree that water-repellent soil conditions associated with LDS are most likely attributed to organic coatings on soil particles that have originated from living or decomposing plants and micro-organisms in the soil (Karnok and Tucker, 2002a; Tucker et al., 1990). Course-textured sandy soils may develop water-repellent conditions over time as a result of those organic deposits on the surface of the soil particles (Karnok and Tucker, 2002a). Also, soil water repellency tends to decrease during the winter months but is more noticeable and severe during the summer (Karnok and Tucker, 2002a). Long, hot, dry periods are most conducive to the formation of water-repellent soils (Karnok and Tucker, 2002b), as well as fairy ring symptoms in turf (Fidanza et al., 2000).

Type I fairy ring and recent field observations

How hydrophobic is the soil under turfgrass affected by type I fairy ring? During the recent hot and dry weather in the Mid-Atlantic region during August 2002, type I fairy ring symptoms were observed in a stand of Kentucky bluegrass on a golf course in Wilmington, Del. Wilted and damaged turfgrass appeared as a large semicircle towards the top of the slope. Soil cores were removed from inside the ring as well as the outside area to determine the water-repellent nature of the soil below. Results from this test site are listed in Table 1. Soil within the ring was severely hydrophobic at the 0 to .39 inches depth as measured by the amount of time required for water to penetrate into the dried soil sample. Soil outside the ring area was not water-repellent at 0 to .39 inches. Hydrophobic soils are typically the most water-repellent at the thatch-soil interface (Kostka et al., 1997). The thatch measured < .2 inches thick at this site. Soil from both the ring and outside areas were not water-repellent at the .78 inches to 1.6 inches depth.

Type I fairy ring symptoms also were observed on a creeping bentgrass putting green on a golf course in southeastern Pennsylvania during August 2002. Again, soil cores were removed to evaluate the level of water repellency that existed at that site. Soil cores were tested from the unaffected inside and outside areas, and from the actual necrotic ring area. Results are listed in Table 2. At the thatch-soil interface, severe water-repellent conditions existed in the ring area, while moderate water-repellent conditions were observed from the inside and outside areas. Soil from the ring was moderately water-repellent down to the 1.2 inches depth, while soil from both inside and outside areas were moderately repellent at only the .39 inches

depth. At this site, creeping bentgrass in the affected rings began to recovery shortly after the putting green was aerified, topdressed, overseeded, fertilized and irrigated.

Type I fairy ring and control opportunities

Soil wetting agents can be used effectively in combination with sound cultural practices to alleviate water repellency in soil (Karnok and Tucker, 2002b). If a putting green is affected by LDS caused by something other than fairy ring, the application of a fungicide will not alleviate the water-repellent soil conditions. For example, Karnok and Tucker (2001) described how one soil wetting agent reduced soil water repellency, but a fungicide applied alone at that same test site had no effect on soil hydrophobicity. In that same study, tank-mix combinations of the chemicals were also effective at reducing soil water repellency.

Water-repellent conditions observed with type I fairy ring are the direct cause of wilted or dead turfgrass. The prudent superintendent has to first alleviate the wilted and drought-stressed turfgrass and rewet the soil. In addition to agronomic inputs to help turf recovery efforts, it is often necessary to use a fungicide targeted toward the basidiomycete fungus. Treating both the symptoms and cause may be the best way to control type I fairy ring in turf.

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