



Treating fairy ring with fungicides, new soil surfactant

Tank-mixing a fungicide and a soil surfactant may control fairy ring symptoms in many locations.

Fairy ring is the common term used to describe circles of mushrooms, lush green circular bands of grass, or rings or arcs of necrotic or dead vegetation in established turfgrass (3,9). Fairy ring symptoms in turf can be observed at any time of year, but they often occur during periods of hot and dry weather, especially in turf that is underfertilized (5,9). Type I symptoms are fairy rings that cause necrotic or dead turf. Type II fairy rings stimulate plant growth as seen in circular bands of dark green, actively growing turfgrass. Soil water repellency and localized dry spot conditions are often associated with both type I and type II symptoms (2,5,7,8). Type III fairy rings produce only mushrooms.

Treatment of fairy ring symptoms

Fairy ring symptoms in turf have been treated by using cultural practices along with fungicides and soil surfactants (also known as wetting agents) in various combinations, timings and application methods (1,3,5,6,7). Nevertheless, reliable and consistent reduction of fairy ring symptoms has been a challenge for superintendents.

For many years, Prostar fungicide was the only product labeled for the basidiomycete fungi that cause fairy ring. Recently, more fungicides, including the products we tested, have been added to the list (Table 1). In addition to the fungicides used in the experiments described here, other fungicides labeled for fairy ring treatment have come on the market: a new formulation of azoxystrobin, Heritage TL; a combination of azoxystrobin and propiconazole, Headway 1.39EC; and triadime-

fon, the active ingredient in Bayleton 50WP.

A new soil surfactant called Revolution also has garnered some interest from superintendents for its use in alleviating localized dry spot and hydrophobic soil conditions, as well as irrigation water management (2,4,9). Recent field trials were conducted to evaluate the performance of some of these fungicides combined with Revolution for control of fairy ring symptoms in turf.

Although these field trials evaluated only one soil surfactant product, presumably other soil surfactants and wetting agents may have a similar effect when tank-mixed with a fungicide. Superintendents should be familiar with the surfactant/wetting agent products they choose to use and know whether the turf and soils at their locations will respond favorably to those products (8).

Experiments and results

California

A curative field trial was conducted at the University of California's Agricultural Operations Research Facility in Riverside. A creeping bentgrass green with a history of type I and II fairy ring symptoms was treated with Endorse, Insignia, Heritage or Prostar fungicide alone and with each fungicide in a tank-mix with Revolution. Treatments were arranged in a randomized complete block design with three replications; plots were 3 feet \times 3 feet (0.9 meter \times 0.9 meter). Treatments were applied through flat-fan nozzles in 2 or 4 gallons of water carrier/1,000 square feet (81.5 or 163.0 milliliters/square meter) on May 2 and 30, 2005. Results from July 29, 2005 (Fig-



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ure 1), indicate better residual performance from fungicides alone when applied at the higher water volume, as well as a consistent reduction in fairy ring symptoms in plots treated with a tank-mix of any of the fungicides plus Revolution at either volume of water carrier.

Pennsylvania

The treatments used in the California study were repeated in 2006 on a perennial ryegrass



Example of type I fairy ring symptoms in turf. Photos by M. Fidanza

Treating the symptoms

Trade name/formulation (active ingredient)*	Treatment/1,000 square feet [†]	State [‡]
Heritage 50WG (azoxystrobin)	0.4 ounce in 2 or 4 gallons water (0.12 gram in 81.5 or 163.0 milliliters/square meter)	CA, PA, SC
Heritage 50WG + Revolution	0.4 ounce in 2 or 4 gallons water + 6 fluid ounces (1.9 milliliters/square meter)	CA, PA, SC
Prostar 70WP (flutolanil)	4.5 ounces (1.37 grams/square meter) in 2 or 4 gallons water	CA, PA, SC
Prostar 70WP + Revolution	4.5 ounces in 2 or 4 gallons water + 6 fluid ounces	CA, PA, SC
Endorse 2.5WP (polyoxin-D)	4 ounces (1.22 grams/square meter) in 2 or 4 gallons water	CA, PA
Endorse 2.5WP + Revolution	4 ounces in 2 or 4 gallons water + 6 fluid ounces	CA, PA
Insignia 20WG (pyraclostrobin)	0.9 ounce (0.27 gram/square meter) in 2 or 4 gallons water	CA, PA, SC
Insignia 20WG + Revolution	0.9 ounce in 2 or 4 gallons water + 6 fluid ounces	CA, PA, SC

Note. Refer to product labels for specific information and instructions for product use.
 *Revolution is a soil surfactant and the other products are fungicides.
[†]Treatments were applied to the California site on May 2 and 30, 2005, and evaluated on July 29, 2005. Treatments were applied to the Pennsylvania site on May 25 and June 20, 2006, and evaluated on July 24, 2006. Treatments were applied to the South Carolina site on July 19 and Aug. 17, 2005, and evaluated on Sept. 13, 2005.
[‡]The California and South Carolina sites were creeping bentgrass greens, and the Pennsylvania site was a perennial ryegrass fairway.

Table 1. Treatments used in our experiments for control of symptoms of type I and type II fairy ring disease in turf.

fairway on a golf course in southeastern Pennsylvania. The same treatments, application rates and water-carrier volumes were applied through flat-fan nozzles on May 25 and June 20, 2006, for curative control of type I and II fairy ring symptoms. Treatments were arranged in a randomized complete block design with three replications, and plots measured 3 feet x 5 feet (0.9 meter x 1.5 meters). Results from June 24, 2006 (Figure 2), reveal a trend of better residual fairy ring control with fungicides alone delivered at the higher water volume when compared to fungicides alone at the lower water volume. At either volume of water carrier, any of the fungicides tank-mixed with Revolution provided better fairy ring control than any fungicide alone.

California

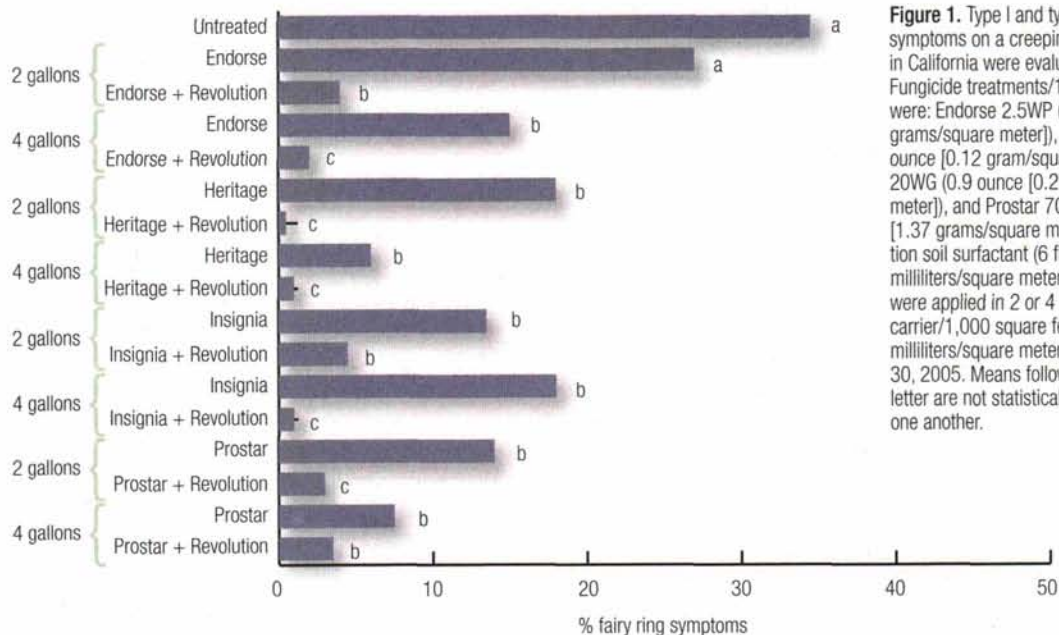


Figure 1. Type I and type II fairy ring symptoms on a creeping bentgrass green in California were evaluated July 29, 2005. Fungicide treatments/1,000 square feet were: Endorse 2.5WP (4 ounces [1.22 grams/square meter]), Heritage 50WG (0.4 ounce [0.12 gram/square meter]), Insignia 20WG (0.9 ounce [0.27 gram/square meter]), and Prostar 70WP (4.5 ounces [1.37 grams/square meter]); and Revolution soil surfactant (6 fluid ounces [1.9 milliliters/square meter]). Treatments were applied in 2 or 4 gallons of water carrier/1,000 square feet (81.5 or 163.0 milliliters/square meter) on May 2 and 30, 2005. Means followed by the same letter are not statistically different from one another.

South Carolina

A curative field trial was conducted in summer 2005 at Clemson University's Pee Dee Research and Education Center in Florence, S.C. A creeping bentgrass green with type I and II fairy ring symptoms was treated with Insignia, Heritage or Prostar fungicides alone and each in a tank-mix with Revolution. Treatments were arranged in a randomized complete block design with three replications, and plot size was 5 feet x 5 feet (1.5 meters x 1.5 meters). Treatments were applied from flat-fan nozzles in 2 gallons of water/1,000 square feet (81.5 milliliters/square meter) on July 19 and Aug. 17, 2005. On Sept. 13, 2005, plots that had been treated with any one of the fungicides plus Revolution showed a significantly greater reduction in fairy ring symptoms than plots treated with only a fungicide (Figure 3).

At all three locations, fairy ring symptoms were consistently reduced when fungicides were applied in a tank-mix combination with the soil surfactant at 2 or 4 gallons of water carrier/1,000 square feet (81.5 or 163.0 milliliters/square meter).

Patience is the key

Fairy ring control with fungicides and soil surfactants may require patience. For example, a creeping bentgrass fairway in Pennsylvania was treated for curative control of type II fairy ring. Each ring was divided into quadrants that were



Example of type II fairy ring symptoms in turf.

about 3 feet (0.9 meter) wide, and each quadrant received one of four treatments: Prostar alone (4.5 ounces/1,000 square feet [1.37 grams/square meter]); Revolution alone (6 fluid ounces/1,000 square feet [1.9 milliliters/square meter]); Prostar + Revolution (4.5 ounces + 6 fluid ounces/1,000 square feet [1.37 grams + 1.9 milliliters/square meter]); and an untreated check.

Three fairy rings were used for this field test.

Pennsylvania

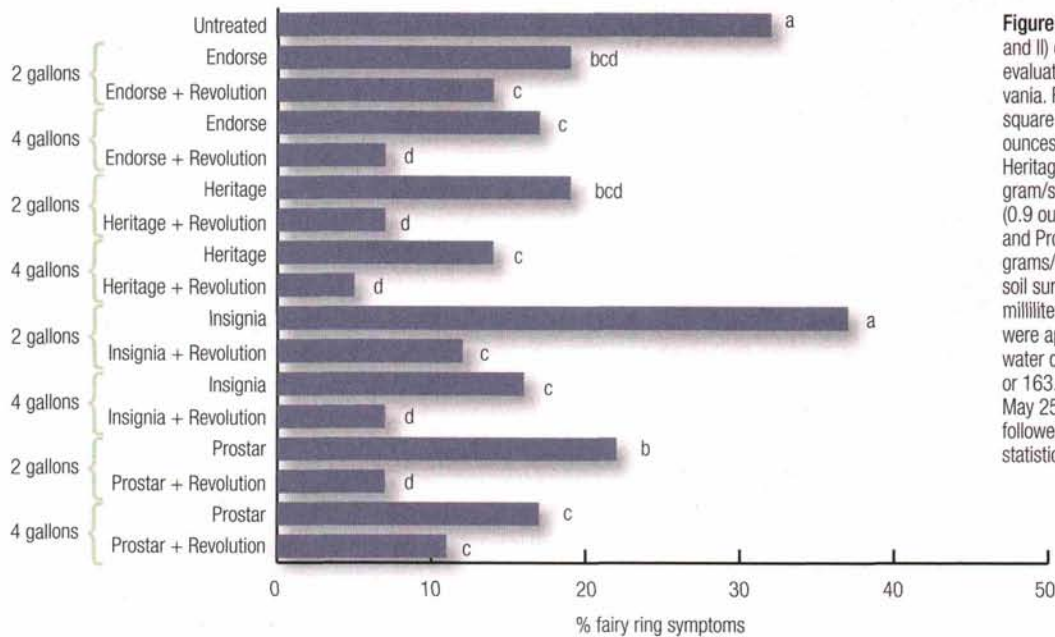


Figure 2. Fairy ring symptoms (types I and II) on a perennial ryegrass fairway evaluated July 24, 2006, Pennsylvania. Fungicide treatments/1,000 square feet were: Endorse 2.5WP (4 ounces [1.22 grams/square meter]), Heritage 50WG (0.4 ounce [0.12 gram/square meter]), Insignia 20WG (0.9 ounce [0.27 gram/square meter]), and Prostar 70WP (4.5 ounces [1.37 grams/square meter]); and Revolution soil surfactant (6 fluid ounces [1.9 milliliters/square meter]). Treatments were applied in 2 or 4 gallons of water carrier/1,000 square feet (81.5 or 163.0 milliliters/square meter) on May 25 and June 20, 2006. Means followed by the same letter are not statistically different from one another.



Example of type III fairy ring symptoms in turf.

All treatments were applied from flat-fan nozzles in 4 gallons of water carrier/1,000 square feet (163.0 milliliters/square meter), followed by 0.1 inch (2.54 millimeters) overhead irrigation. All treatments were applied July 1 and again July 30, 2003.

South Carolina

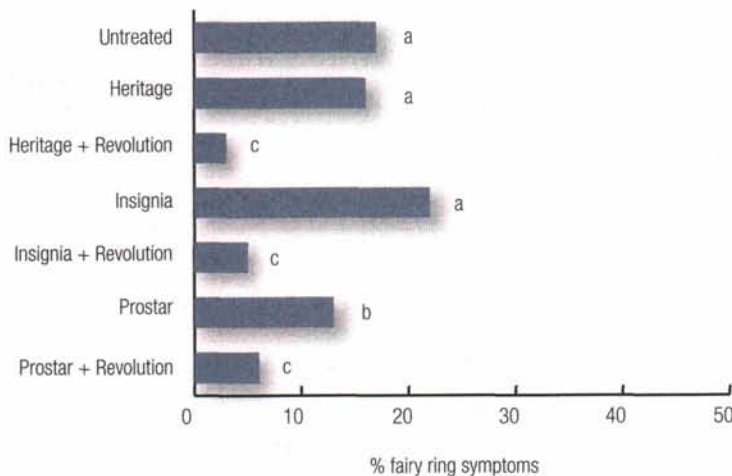


Figure 3. Fairy ring symptoms (types I and II) on a creeping bentgrass green, evaluated Sept. 13, 2005, in South Carolina. Fungicide treatments/1,000 square feet were: Heritage 50WG (0.4 ounce [0.12 gram/square meter]), Insignia 20WG (0.9 ounce [0.27 gram/square meter]), Prostar 70WP (4.5 ounces [1.37 grams/square meter]); and Revolution soil surfactant (6 fluid ounces [1.9 milliliters/square meter]). Treatments were applied in 2 gallons of water carrier/1,000 square feet (81.5 milliliters/square meter) on July 19 and Aug. 17, 2005. Means followed by the same letter are not statistically different from one another.

The type II fairy ring symptoms persisted through July and August, but by September all rings had dissipated or were “masked” after a fairway fertilizer application. Therefore, none of the treatments appeared to work in 2003. In 2004, however, type II symptoms reappeared again by mid-July with a peculiar “disruption” in each of the rings. The disruption, the only symptom-free area of each ring, was the section that had been treated with the Prostar + Revolution tank-mix in 2003.

The study was repeated in 2004. The same treatments applied in 2003 were applied once in early July and again in early August to three different type II rings on the same fairway that had been treated in 2003. Again, the symptoms persisted until early September, when all ring symptoms faded away after a fall fertilizer application. In summer 2005, no ring symptoms appeared in that fairway. This was attributed primarily to cultural practices (that is, an increase in fertilization of the fairway). Other factors that may have contributed to the disappearance of fairy ring symptoms are the application of the fungicide and fungicide + surfactant treatments, as well as the natural cycle of fairy ring fungi growing in turf.

Management recommendations

Knowing where and when fairy ring occurs may help superintendents plan for a preventive as well as a curative control program. If time, resources and turf conditions allow, first use needle tines to aerate the area affected with fairy ring and then treat with a fungicide/soil surfactant program with enough water carrier and supplemental irrigation to move the treatment into the thatch and root zone. In primarily sand-based sites, excessive amounts of water could push the treatment past the intended target area. Currently, a combination of cultural practices, fungicides labeled for fairy ring, and soil surfactants is the best approach to combating fairy ring.

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In this creeping bentgrass fairway, the "disrupted" section in this type II ring appeared in summer 2004, and was attributed to the fungicide plus soil surfactant tank-mix treatments from summer 2003. Type II fairy ring symptoms were more pronounced in this underfertilized fairway, as indicated by the active dollar spot.



The research says

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Literature cited

1. Blenis, P.V., L.B. Nadeau, N.R. Knowles and G. Logue. 1997. Evaluation of fungicides and surfactants for control of fairy ring caused by *Marasmius oreades* (Bolt. Ex. Fr.) Fr. *Hort-Science* 32(6):1077-1084.
2. Cisar, J.L., K.E. Williams, H.E. Vivas and J.J. Haydu. 2000. The occurrence and alleviation by surfactants on soil water repellency on sand-based turfgrass systems. *Journal of Hydrology* 231-232:352-358.
3. Couch, H.B. 1995. Diseases of turfgrass. Kreiger Publishing, Malabar, Fla.
4. Dekker, L.W., K. Oostindie, S.J. Kostka and C.J. Ritsema. 2003. Treating water repellent surface layer with surfactant. p. 281-289. In: C.J. Ritsema and L.W. Dekker, eds. Soil water repellency — occurrence, consequences, and amelioration. Elsevier Publishing, Amsterdam, Netherlands.
5. Fidanza, M.A. 1999. Conquering fairy ring disease with new tools. *Golf Course Management* 67(3):68-71.
6. Fidanza, M.A., D.L. Sanford, H. Wetzel Jr. and J.S. Nattle. 2003. Evaluation of fungicides, a soil wetting agent, and cultural practices for curative fairy ring control, 2001. *Fungicide and Nematicide Tests* 58:T036. DOI: 10.1094/FN58.
7. Fidanza, M.A., P.F. Colbaugh, H.B. Couch, S.D. Davis and D.L. Sanford. 2002. Conventional and innovative methods for fairy ring management in turfgrass. *Science and Golf* 4:631-642.
8. Karnok, K.J. 2006. Which wetting agent is best? *Golf Course*

9. Kostka, S.J. 2000. Amelioration of water repellency in highly managed soils and the enhancement of turfgrass performance through the systematic application of surfactants. *Journal of Hydrology* 231-232:359-368.
10. Smiley, R.W., P.H. Dernoeden and B.B. Clarke. 2005. Compendium of turfgrass diseases. APS Press, Minneapolis.

GCM

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→ The three types of fairy ring symptoms are: necrotic or dead turf (type I), circular bands of dark green turf (type II) and mushrooms (type III).

→ Turf exhibiting type I and type II fairy ring symptoms was treated at locations in three states with various fungicides and tank-mixes of each of the fungicides + the soil surfactant Revolution with either 2 or 4 gallons of water as a carrier.

→ At all three locations, the tank-mix of the fungicide and the surfactant consistently reduced fairy ring symptoms.

→ Applying any of the tested fungicides in 4 gallons of water carrier rather than 2 gallons reduced fairy ring symptoms. However, applying a tank-mix of any of the tested fungicides plus the surfactant in either 2 or 4 gallons of water carrier produced a similar reduction in fairy ring symptoms.