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TURFGRASS RESEARCH REVIEW

TAILOR CONTROLS TO SPECIFIC FAIRY RING FUNGUS

***Influence of the nitrogen fertility level on* Tricholoma *fairy ring development in Merion Kentucky bluegrass* (Poa pratensis *L.)*.** *J. B. Beard, J. M. Vargas Jr. and P. E. Rieke. 1973. Agronomy Journal. 65:994-995. (from the Department of Crop and Soil Sciences, Michigan State University, East Lansing, Mich. 48824).*

This paper reported the influence of nitrogen fertilization rates on the incidence of *Tricholoma* fairy ring. The experiments were conducted on a mature, high quality Merion Kentucky bluegrass turf that had been established in May of 1962. The area was mowed twice weekly at 1.2 inches with clippings returned. Irrigation was applied as needed to prevent wilt. In September of 1962 and 1963, 2, 4-D was applied for broadleaf weed control. No other herbicide or fungicide applications were made. Chlordane applications were made in the spring of 1963 and 1966. Soil on the experimental site was a sandy loam having a pH of 7.1. The soil phosphorus and potassium levels at the time of establishment were medium and high, respectively.

Differential nitrogen fertility levels were established in the spring of 1967. They were 0, 4, 8, 12 and 16 pounds of nitrogen per 1,000 square feet per year. Each of the nitrogen treatments were split into four equal applications made on May 10, June 20, August 1 and September 10 of each year. The plot size was three by 30 feet in a randomized block design of three replications.

Differential concentrations of fairy ring first started to appear in the fall of 1968, 1.5 years after initiation of the nitrogen treatments. There were no fairy rings visually evident on the plots prior to this period. Plots receiving zero and four pounds of nitrogen per 1,000 square feet per year had no fairy rings. An average of three fairy rings per plot occurred on those receiving eight pounds of nitrogen, whereas five and six rings per plot occurred at the 12 and 16 pound nitrogen rates, respectively.

The fungal organism causing these fairy rings was identified as *Tricholoma sordidum* Fr. The rings varied from 10 to 18 inches in diameter in the fall of 1968 and expanded to between 18 and 30 inches in diameter during the 1969 growing season. Characteristics associated with the rings included (a) an inner zone of stimulated grass with the shoots being darker green and taller than the adjacent unaffected area; (b) a middle zone of stunted grass plants, and (c) an outer zone of stimulated shoot growth. There were some brown mushrooms associated with the rings. They were generally located in the inner zone of stimulation. Followup field surveys revealed that *Tricholoma sordidum* is one of the most common fairy ring producing organisms occurring in Michigan turfs, including golf courses.

Soil pH determinations made on plots receiving various nitrogen treatments indicated that this is not a key factor in the initiation of this fairy ring. Similarly, potassium fertility levels of 0, 2, 4, 6 and 8 pounds of K per 1,000 square feet per year applied in four equal applications had no effect on the incidence of *Tricholoma* fairy ring. Thus, nitrogen was concluded to be the main factor.

Comments: To the average golfer, all fairy rings appear alike: they occur in dark green circles ranging in diameter from two to 15 feet with the center zone sometimes being dead and/or with mushrooms occurring in association with the band of dark green, stimulated grass.

Actually, there are more than 45 known fungi species that can cause the general fairy ring symptoms. These fairy ring symptoms can be divided into three groups. In one group the grass in a distinct portion of the ring is either completely killed or badly thinned. A second group is characterized by rings that appear only as dark green bands having stimulated grass growth due to increased nitrogen availability. There is also a third group of fungi, which can be isolated, but cause no visible symptoms on turfgrass areas.

When two rings come in contact with each other, fungus activity ceases causing that portion of both rings to be dissipated visually and resulting in the appearance of half moon or scallop-ring effects. The ring advances outward at a rate ranging from several inches to two feet per year. The rate of advance varies with the specific species involved and with the existing soil, atmospheric and environmental conditions.

Those types of fairy ring that cause a distinct band of dead grass are objectionable on greens, fairways and tees. The cause of death varies with the particular species involved and can be due to (a) a lack of moisture, (b) parasitism by the causal organism or (c) to the release of toxic gases by the causal organism. Usually the zones of dead grass are characterized by symptoms similar to those for localized dry spots. They are extremely dry and very difficult to rewet, even when there is an abundance of soil moisture in adjacent areas. Basically their behavior is hydrophobic or water repellent.

The second group of fairy rings, characterized by a dark green band of stimulated shoot growth, may not be particularly objectionable on fairways and tees, but can create serious problems on greens where the stimulated zone of grass growth can affect ball roll during putting, even when the greens are mowed daily.

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Fairy rings are frequently associated with decomposing organic or woody materials. Results of the study described in this article indicate the importance of the nitrogen nutritional level on fairy ring development in Kentucky bluegrass. Higher nitrogen fertilization rates stimulate the development of certain fairy rings species, *Tricholoma* fairy ring in this case. Earlier recommendations concerning fairy ring problems have suggested the use of nitrogen fertilizer to mask the dark ring of stimulated grass growth. While this may be a possibility for certain species that are not affected by nitrogen fertility levels, this practice should be avoided for some species, such as *Tricholoma*.

The obvious conclusion is that there are a great diversity of organisms that can be associated with fairy ring activity. Thus, the cultural practices and chemical controls of fairy ring should not be applied uniformly to all fairy rings, but rather to the particular species involved.

If fairy ring occurs and becomes objectionable on greens, there are two alternative maintenance procedures. One involves removal by digging out and replacing the mycelium contaminated soil. The affected areas should be removed to a depth of 12 to 18 inches and for a distance of 18 to 24 inches outside of the infected area. When removing the soil, it is important that none is allowed to drop on adjacent, unaffected turfgrass areas. Replacement of the soil should be done from a source that is known to be free of fairy rings.

A second procedure for the elimination of fairy rings on greens involves fumigation of the infected area for a distance of 18 to 24 inches beyond the outer edge of the ring. Prior to fumigation with such materials as methyl bromide or formaldehyde, the sod should be stripped from the area and the soil cultivated by spading or deep cultivation through coring. Again, it is important that none of the infected soil spill on adjacent, unaffected areas. Both methods involve kill and reestablishment of the infected turfgrass area. These are two of the more positive approaches to control of undesirable fairy rings.

Another less expensive and time consuming approach on fairways and tees is through saturating the rings with

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with city water would run $411 a day, whereas watering the same course with filtered effluent costs about $97 a day—a considerable savings, even though construction of a filtration plant would cost the club $280,000. Considering the scarcity of potable water in that region, the cost of a sewage treatment plant is a small price to pay to recycle water for recreational use.

Another consideration to be taken into account when deciding to use effluent or not is the presence of nutrients in effluent water. It is possible that in the next few years, a shortage of nitrogen fertilizer may occur. Effluent, according to a group of California researchers who analyzed effluents from 15 cities, contains 60 to 100 pounds of nitrogen in one acre foot, 60 to 100 pounds of phosphorus and 20 to 40 pounds of potassium.

Many minor elements, including sulphur, magnesium, calcium, iron, manganese, boron, zinc and copper are also present to some degree in sewage effluents. The fertilizer value of sewage has been estimated by some researchers to be somewhat greater than its value as water.

This viewpoint is not shared by men who used effluent on bermudagrass at Llano and Fredericksburg, Tex. At Llano, sewage effluent was considered to have very little more fertilizer value than well water. There was a marked difference in greenness between fertilized and unfertilized plots at Fredericksburg where the effluent was used.

Properly treated sewage effluent has no objectionable odors or other undesirable characteristics. Many cities in Texas, such as Corpus Christi, Midland and Lubbock, use sewage effluent in irrigating municipal golf facilities. Many of the Planned Unit Developments springing up around the state are also utilizing effluent for the golf courses.

Information about the cost of effluent to the user is scanty. The most common arrangement is the one in which the effluent is donated to the user if he will defray the costs of removing it from the disposal plant or some area of deposit. In other arrangements, the user pays a stipulated sum for the use of the effluent. Others are charged by quantity, so much per 1,000 gallons. Costs from nine different cities ranged from $.01 per 1,000 gallons to $.25 per 1,000 gallons. As water resources become more acute, it is probable that higher charges will be instituted. Engineers in San Antonio, Tex., calculated the cost of producing a million gallons of effluent at $35, including chlorination. A million gallons equals 3.07 acre feet.

The use of treated effluent water in automatic irrigation systems is a desirable means of utilizing water that heretofore has been thought impractical. At present, western, southwestern and Rocky Mountain states have a greater need for effluent. These states have the fastest-growing populations and the least amount of natural water sources. With pollution becoming a greater public issue, certainly other areas of the country will need to evaluate their present sewerage systems. In time, modern technology will reduce the cost of filtration and purification systems; then effluent water will be an inexpensive source of irrigation water for golf courses. □

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water. The immediate, hydrophobic ring should be thoroughly cultivated by coring or forking to a depth of eight to 10 inches. Subsequently, the area should be saturated with water and maintained in this condition for a period of three to six weeks. Rewetting of the ring can be facilitated by the use of a wetting agent, whereas deeper wetting of finer textured soils is enhanced by the use of tree root feeding-probes. This water-saturation approach frequently results in disappearance of the visible ring symptoms, but there is no information to indicate that it is effective for all species.

Another approach that has been attempted involves cultivation of the ring by coring or forking followed by application of a concentrated fungicide solution of the appropriate type. It is preferably applied directly into the holes or else by a general soil drench application at a lower concentration. Results utilizing this technique have been erratic at best, with some suppression of the causal organism occasionally reported.

It is obvious from this discussion of fairy ring control that it can be a serious problem if it occurs in greens. □