

Water-repellent soils

Part 2: More questions and answers

Fungicides, deep irrigation, wetting agents, aerification and careful use of topdressing can all be used to defeat LDS.

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Editor's note: This is the second of a two-part series about water-repellent soils on the golf course. In the June 2002 issue of GCM, the authors answered some of the questions that superintendents often ask about hydrophobic soils.

In the preceding issue of *GCM*, we discussed some questions superintendents frequently ask about the characteristics of water-repellent soil, the best way for determining whether localized dry spots (LDS) are being caused by hydrophobic soils, and the use of wetting agents as a tool for managing water-repellent soil. The earlier article also provides some background for the information presented here.

What is the relationship among fairy ring, LDS and water-repellent soil?

The organisms that cause fairy ring can and do result in LDS and water-repellent soil. Fairy ring fungi may cause LDS in several ways. For example, these organisms also decompose organic matter and thus may contribute to the organic coating often associated with water-repellent soils. The presence



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To avoid potential problems associated with hydrophobic topdressing, superintendents should conduct the water-droplet test before using all topdressing and root-zone mixes.

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- Topdressing and root-zone mixes should be tested for soil hydrophobicity.
- Thorough irrigation will reduce the occurrence of LDS.
- Increasing application rates will not necessarily improve wetting agent performance.
- New research may provide more answers to problems with soil hydrophobicity.

Key points

of thick fungal mycelia also may prevent the movement of water into the soil. Finally, toxic materials associated with certain species of fairy ring fungi may also cause LDS.

Some fungicides are very effective in controlling fairy ring, but fungicides are not a cure-all for every form of LDS. Our research has shown that LDS caused by water-repellent soil occurs without the presence of fairy ring fungi. There would be little value in applying a fungicide in such a situation. Superintendents are encouraged to look for the typical signs of fairy ring associated with LDS such as circles of mushrooms and lush green circular bands of turfgrass before attempting to control LDS with a fungicide. The water-droplet test (for details, see the June 2002 article) should be performed to determine the presence of hydrophobic soil.

Why do my greens continue to show LDS even though I aerify and topdress regularly?

First, it is important that the superintendent determine the cause of LDS. The water droplet test will show the presence of hydrophobic soil. As long as there is organic matter decomposition, the potential for water-repellent soil

exists. Even assuming the topdressing material being applied is not hydrophobic (see the next question), over time, this “nonhydrophobic” material has the potential of becoming hydrophobic. Furthermore, a tremendous amount of aerification and topdressing would be required to displace or significantly modify the existing water-repellent soil.

Nonetheless, aerification can be beneficial in combating LDS caused by hydrophobic soil. Water-repellent soil occurs primarily in the top 2 inches of the soil profile. Any management practice that encourages deeper and more extensive root growth, especially below the top 2 inches of the profile, will help reduce the occurrence of LDS.

Could my topdressing mix be hydrophobic?

Until recently water-repellent topdressing materials (sand and organic matter) were not a concern. With few exceptions, soils will not become water-repellent until certain types of plant species — including some turfgrasses — have been established in an area for some time. Considering the sources of most sands used in topdressing mixes today, the chances of their being hydrophobic were believed to be small. The relatively small amounts of the different types of organic matter commonly used in topdressing mixes also would have suggested little reason for concern.

With the assistance of Norm Hummel, Ph.D. (Hummel and Co. Inc., Trumansburg, N.Y.), we recently evaluated 33 topdressing or green mixes for water-repellency. Although our results are preliminary, we found that certain mixes were, in fact, hydrophobic. At this time, we are investigating whether the sand or the organic matter component or a combination of the two are responsible for the water-repellency.

We are unsure about the possible ramifications of using a slightly hydrophobic topdressing mix. Important factors determining the long- and short-term effects of hydrophobic topdressing mix would appear to be the amount and



Photo courtesy of The Toro Co.

As much as 1 inch of water may be required to wet the hydrophobic zone sufficiently to reduce the occurrence of LDS.

frequency of application and whether the area was cored before topdressing. Until more information is available, the water droplet test should be conducted on all topdressing and root-zone mixes.

How important is irrigation when dealing with water-repellent soil and LDS?

We believe irrigation practices can have a tremendous impact on managing hydrophobic soil. As explained in the June 2002 *GCM* article, each water-repellent soil has a critical moisture point. When soil moisture is above this point, the water-repellency effect is temporarily eliminated. When soil moisture falls below this point, the soil becomes hydrophobic.

Our research has shown that applying small amounts of water rarely raises the soil moisture content above the critical point or maintains it above this point for any extended period of time. Applying small amounts of water will rarely wet the entire hydrophobic zone. Therefore, it is not surprising that LDS returns even after irrigation.

Applying sufficient water to wet the entire hydrophobic zone will often reduce the occurrence of LDS for a much longer period. Thorough wetting of the soil helps explain why superintendents often report the disappearance of LDS for up to several weeks after a good soaking rainfall. We believe that *at least* enough water should be applied to wet the hydrophobic zone thoroughly. (The exact depth of the zone can be determined by using the water-droplet test.)

In many cases, thoroughly wetting the hydrophobic zone will require applying as much as 1 inch of water. Our discussions with superintendents suggest this is rarely done for many practical reasons. Aside from those reasons, it behooves the superintendent to try, at least occasionally, to irrigate sufficiently to wet the critical hydrophobic zone. In some cases, this will probably require the use of a wetting agent. In addition to treating LDS, deep irrigation encourages deeper rooting and flushes the soil of accumulated salts.

Do wetting agents hinder root growth?

Some earlier reports in the literature indicate that certain wetting agents may negatively affect root growth. Using the University of Georgia's underground root observation laboratory (rhizotron), we recently applied a wetting agent to a soil profile with a 4-inch layer of water-repellent soil. The experiment showed significantly improved root growth of Penncross creeping bentgrass (see our article in the July 2001 issue of *GCM* for more details). Although certain wetting agents may improve root growth, we believe their more important benefit is improving soil moisture content.

Do season-long wetting agents really last all season?

We have tested two of the "season-long" wetting agents and found a significant reduction in soil water-repellency for as long as five months. In some locations, five months would encompass the majority of the season, but in others, it would not. The duration of effectiveness also can be affected by weather conditions, cultural practices, the amount of soil organic matter present in the form of thatch or mat, and the degree of soil hydrophobicity. Any of these factors or a combination of them may reduce the duration of effectiveness of these products.

Will increasing the application rate make a wetting agent last longer?

Increasing the application rate of a wetting agent beyond the label recommendation will not necessarily increase the duration of effectiveness. Wetting agents differ in their chemical makeup. Using more of a product will not change its chemistry. The obvious caveat is that, like all chemicals used on turfgrass, wetting agents should be applied only according to label recommendations.

I recently saw an advertisement saying that a certain wetting agent worked by removing the organic coating from the soil particles. Is this true?

At this point, we don't know. To our knowledge, this claim for this particular product has not been substantiated by research conducted in this country. Evidently, the research supporting this mode of action was conducted overseas. We have recently entered discussions with this company about testing the product to determine its effect on the organic coating associated with soil water-repellency.

Conclusions

The questions presented here and in the June 2002 *GCM* article come from a survey of more than 300 golf course superintendents. Participants responded to the question, "If you could have one question answered about wetting agents, what would it be?" Respondents posed more than 150 different questions. We have answered the most frequently asked questions, or those for which we have fairly definite answers.

Other questions not discussed here include:

- Which wetting agents move best through the soil profile?
- Which formulation is the best: pellets, liquids or granulars?
- Which wetting agent is least affected by thatch?
- Which wetting agent is safest to use on cool-season turfgrasses?
- Do wetting agents perform the same when applied to a cool-season vs. a warm-season turfgrass?
- Why do wetting agents cost so much?
- Which wetting agent is the best buy?
- Why are there so many wetting agents? Are there significant differences among them?
- Are split applications a few days apart better than a single full application?
- Will using a wetting agent at a rate higher than the recommended one decrease the level of water-repellency even more?
- What is the minimum amount of water that should be used when applying a wetting agent?
- Does long-term use of a wetting agent have detrimental effects on the

soil and/or turf?

- Will aerifying before applying a wetting agent improve its performance?
- Besides treating LDS, what are some other uses of wetting agents?
- Can soil be modified physically to avoid becoming hydrophobic?

These questions are a few of many from superintendents regarding wetting agents and their use. Obviously, we don't have all the answers, but several studies under way will help us to understand better the most effective uses of wetting agents. We will share our findings in future *GCM* articles. ■

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