Dry spots return with summer

Localized dry spot and water-repellent soils require careful, constant management.

Keith J. Karnok, Ph.D., and Kevin A. Tucker

As summer approaches, golf course superintendents can be certain that a major headache is about to return: localized dry spot. Also known as "hot spots" or "isolated dry spots," localized dry spot is a symptom of a variety of soil and plant disorders or anomalies.

Localized dry spot — identifiable as an irregular area of stressed turfgrass — can be a result of certain diseases or insects, soil compaction, improper chemical usage, excessive thatch, salts, soil layering or poor irrigation coverage.

Unfortunately, localized dry spot caused by water-repellent (or hydrophobic) soil presents a different challenge. Water-repellent soil often occurs in combination with other stresses. It can be a virtually invisible condition, and it varies in severity within relatively small areas.

KEY POINTS

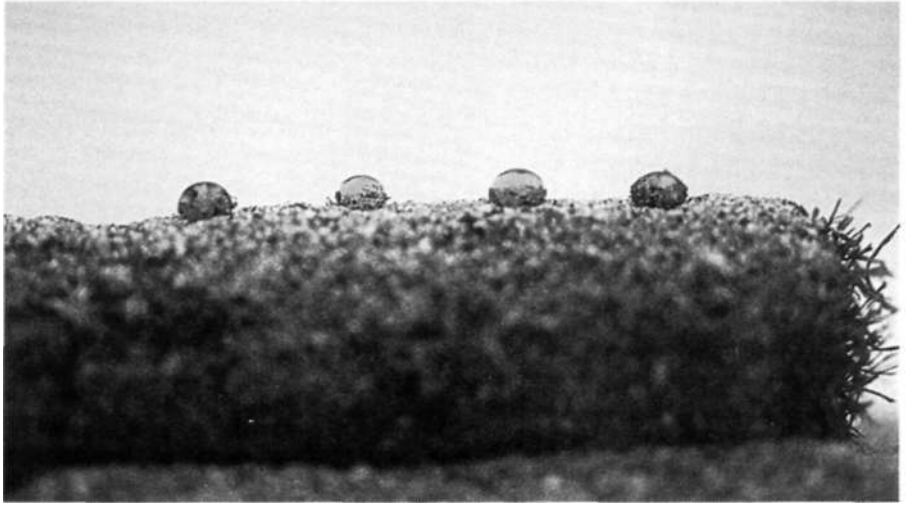
- I Dry spot in turf may have many causes, including a condition known as hydrophobic or water-repellent soil.
- I For a treatment to be successful, the actual cause of the localized dry spot must be known.
- I Fungicides will not "cure" or make an already hydrophobic soil "hydrophilic" or non-water-repellent.

Water-repellent soil

The paradox surrounding localized dry spot caused by water-repellent soil is that this potentially devastating condition is usually the result of a very natural and necessary biological process — organic matter decomposition.

It can exist at the surface alone (in the top 1/2 inch of soil), or it can extend several inches into the soil. Unfortunately, there is no "quick fix" or "magic cure" for this soil condition.

Organic matter decomposition produces many benefits, including the prevention of excessive organic matter accumulation and the release of plant nutrients. Unfortunately, certain microscopic organic compounds can partially coat or



Dyed blue for easy visibility, these droplets demonstrate the water repellency of a soil core taken from a hydrophobic area. The repellency is evident even near the bottom of the core (at left).

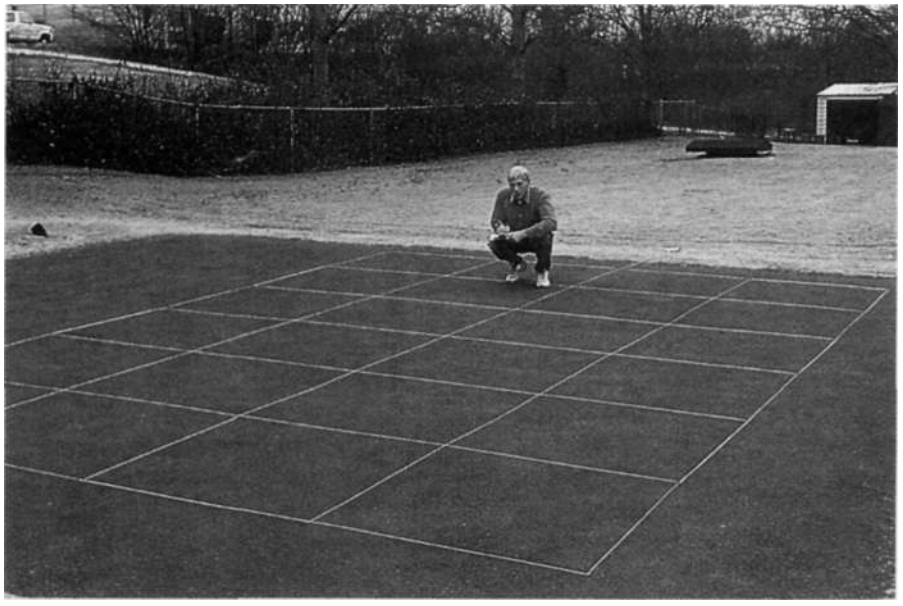
adhere to soil and sand particles. When these substances dry beyond a certain point, their chemistry changes, and they become water-repellent.

In fine-textured soils, this rarely creates problems because the innate water retention of these soils can mask a hydrophobic condition. Therefore, stresses other than hydrophobic soil typically cause the localized dry spots found in fine-textured soils.

In coarser or sandy root zones, such as sand-based greens or where the native soil has a high sand content, water repellency is more likely. The combination of poor water retention and frequent wetting-and-drying cycles leads to soil hydrophobicity, which produces localized dry spot.

Management is the only option for the superintendent in these cases. Even if there was a process for removing the organic water-repellent substance from the soil, it would soon return because organic matter decomposition and root growth (apparently an integral part of the process) would continue to produce water-repellent materials.

The goal is to minimize stress while promoting the healthiest plant possible. It is particularly important to encourage a deep and extensive root system. If the root system can proliferate in the water-repellent area or extend below the soil depth of the water repellency, localized dry spot can be reduced.



Keith J. Karnok, Ph.D., observes the progress of a University of Georgia research project under way on an experimental green constructed with a uniform 3-inch surface layer of water-repellent sand.

Irrigation practices

Water-repellent soil will not repel water once it is wetted. In fact, as long as the soil remains wet, the symptoms of water-repellent soil (localized dry spot) will rarely be evident.

Some superintendents may be unaware of a soil's potential water repellency because their irrigation practices prevent the root zone from drying to the necessary critical level. The critical moisture level depends on such factors as soil type, amount of soil organic matter present, turfgrass species, and the extent and severity of hydrophobicity.

Prolonged wetness may, however, result in increased weed problems, shallow turf rooting, soil compaction, algae growth, excessive water usage, increased disease problems, increased pesticide usage, decreased pesticide effectiveness, increased fertilizer application and an inferior playing surface. If the root zone moisture level diminishes below the critical point, soil water repellency will become evident as localized dry spot.

In most turfgrass situations, particularly on golf greens and sports fields, playability and deep root growth are enhanced by allowing the surface to dry between watering cycles. Unfortunately, repeated wetting and drying promotes soil water repellency.

In addition, some areas will dry faster and more thoroughly than others. Consequently, severe drying of the upper soil profile in certain isolated areas may result in significant root dysfunction or even death.

Although superintendents would like complete control over how wet or dry a particular turf is, this is difficult to achieve with water-repellent soils. The use of wetting agents may be an option.

Generally, deep irrigation is recommended for most turfgrass areas (excluding areas being established and shallow-rooted stands). This is particularly true for sand-based greens. Deep

and thorough irrigation ensures the movement of accumulated salts and other materials out of the root zone, displacement of soil gases and replenishment of soil oxygen.

Wetting agents

In severe cases of localized dry spot caused by water-repellent soil, use of a wetting agent is the best approach. It's imperative that soil moisture be restored as rapidly as possible. Most wetting agents on the market will improve soil moisture enough to relieve plant stress.

However, the performance of wetting agents can depend on many factors. The severity and depth of soil water repellency may have a significant effect, although independent university researchers have reported little on the comparative performance of specific wetting agents at various severities of soil water repellency. In addition to relieving "acute" localized dry spot caused by water-repellent soil, wetting agents may be of value in overall moisture management of hydrophobic soils.

The true impact of variable wetting and drying in a hydrophobic soil is unknown. In an ongoing study at the University of Georgia's rhizotron (an underground root observation laboratory), we are examining the effects of wetting agents on summer root growth of creeping bentgrass *(Agrostis palustris)* in water-repellent soil. Uniform application of a wetting agent over a water-repellent area should help to reduce the variable wetting and drying effects that might be present.

Reports from superintendents suggest that certain wetting agents hold moisture at the soil surface, whereas others may provide a more uniform wetting of the soil profile. This seems to be particularly true during periods of continuous rainfall or reduced evapotranspiration and in poorly drained areas.

There could be advantages to a wetting agent that tends to hold water at the soil surface. Shallow-rooted turf, drought-prone areas such as south-facing slopes, or areas exposed to frequent wind could benefit, although university research hasn't yet validated these uses.

Past research at the University of Georgia has shown there are differences among wetting agents in terms of phytotoxicity, application rates, frequency of application, ease of handling and application, and cost. Our current research is intended to uncover other differences that will allow superintendents to select a particular product for a specific situation.

Soil amendments

Among soil amendments, sand substitutes such as calcined clay, diatomaceous earth and zeolite have superior moisture-retention characteristics. For example, in University of Georgia research, coring and topdressing with diatomaceous earth increased the moisture retention of a water-repellent soil. Before adding a sand substitute to a root-zone mix, however, the sand substitute and the mix should be analyzed by a soil-testing lab for their approximate moisture-retention characteristics.

Cultivation

Cultivation and aerification are often useful in managing water-repellent soils. Any practice that encourages a deeper and more extensive root system will help the turfgrass plant better tolerate a hydrophobic soil. Also, where excessive thatch, mat or layers of organic matter are present in or above a water-repellent zone, cultivation may be necessary to move wetting agents into the water-repellent soil.

When the hydrophobic condition extends more than two inches into the soil, cultivation may be necessary prior to the application of a wetting agent to ensure the deepest possible movement of the wetting agent.

Fungicides

Another common cause of localized dry spot in turfgrass areas is fairy ring. Fairy ring organisms are among the fungi known as basidiomycetes, which decompose organic matter.

Turfgrass death may be caused by:

- Complete permeation of the soil by-fairy ring fungal mycelia (mass of slender filaments) that prevents the movement of water into the soil
- Toxic metabolite produced by some fairy ring species when they colonize the roots of certain turfgrasses
- Hydrophobic coatings put on soil particles during the decomposition of organic matter by the fungi

Most likely, some combination of these three scenarios is responsible for localized dry spot caused by fairy ring.

Early treatment of fairy ring with a fungicide will prevent localized dry spot by controlling the fungus. However, a fungicide will not necessarily prevent the formation of water-repellent soil when other, non-fairy ring organisms are responsible for its formation.

Fungicides will not "cure" or make an already hydrophobic soil "hydrophilic" or non-water-repellent. But when fairy ring is diagnosed, the use of a fungicide should be considered. In almost all cases they are most effective when used in conjunction with a wetting agent.

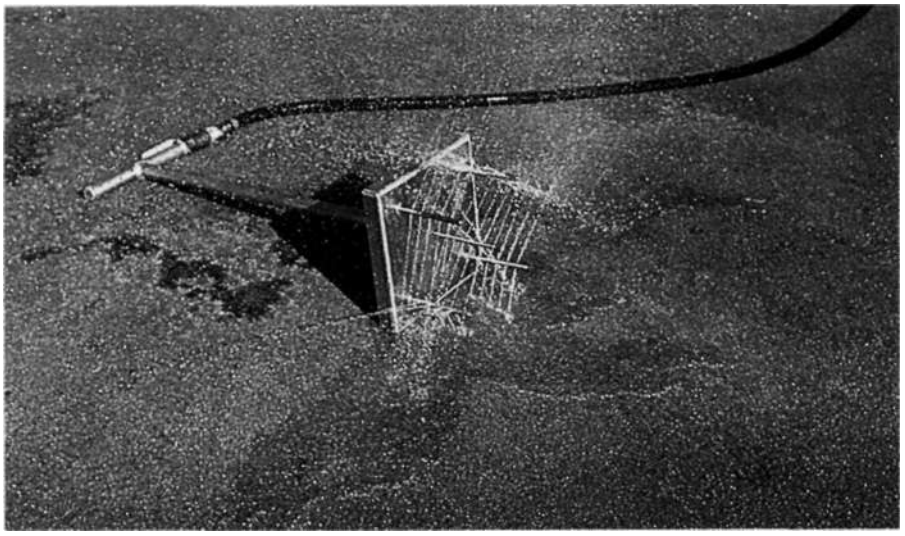
Biostimulants

"Non-nutritional, growth-enhancing" products (biostimulants) have become very popular in recent years. Biostimulants usually contain some combination of plant hormones, enzymes, bacteria, yeast, amino acids, sugars, humic substances and various plant nutrients. However, their effectiveness is not well documented by university research.

There have been reports (some from university research as well as from testimonials) that certain biostimulant materials may enhance root growth. If this is the case, then the use of such materials could be of value in managing turfgrass growing in a water-repellent soil.

There is no evidence, however, that these materials "cure" soil hydrophobicity directly. By the same token, there is no evidence that they induce or make soil water repellency worse. Before relying heavily on such materials, you should request university test results and conduct your own on-site testing with small quantities.

Localized dry spots caused by water-repellent soil will continue to be a management challenge for most superintendents. The use of sound agronomic practices, coupled with the use of wetting agents and possibly certain sand substitutes, will help minimize the effects of this perennial problem. •



Wetting forks can alleviate localized dry spot caused by water-repellent soil. Tines should have water-emitting holes beginning at least 1/2 inch from the top of the foot plate.

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