

Fight localized dry spots through the roots

Using wetting agents to treat an entire green may be the best way to combat localized dry spots.

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

Localized dry spots (LDS) — sometimes referred to as isolated dry spots, dry patch or hot spots — can be defined as irregular areas of turfgrass that, for no apparent reason, begin to show signs typical of drought stress. Possible causes of LDS include excessive thatch, compacted soil, poor irrigation coverage, steep sloping grade (water runoff), high soil salinity, improper chemical usage, insects, diseases and water-repellent soil.

It is well substantiated that bentgrass (*Agrostis* species) root growth declines significantly with the onset of summer stress conditions. Along with high temperatures, the water-repellent rooting mediums often found on sand-based golf greens further stress the plant. Because water-repellent soils may vary in severity across a golf green, there can be variable wetting and drying of the rooting medium, causing variable root and shoot growth. Currently, wetting agents are the most effective method for reducing or eliminating LDS caused by water-repellent soil. But how much do wetting agents influence root growth in moderately to severely water-repellent soil? And what are the benefits or drawbacks of applying a wetting agent to the entire green or simply spot-treating the LDS area?

A study was conducted in the University of Georgia rhizotron to determine the effects of a wetting agent

on bentgrass roots growing in water-repellent soil. The rhizotron, which comprises 24 observation chambers, permits nondestructive and continuous measurement of root growth under field conditions.

Materials and methods

To simulate the water-repellent layer commonly found on sand-based golf greens, 4 inches of the top root-zone mix (USGA specifications) was replaced with a layer of hydrophobic soil. The hydrophobic soil layer was a mixture of 85 percent sand and 15 percent peat with 2.6 percent organic matter content. Following the standardized test used for determining the degree of soil-water repellency, the soil was considered moderately to severely hydrophobic. The chambers were sodded with Penncross sod. Throughout the study, the plot area received a balanced fertility program, pest control and sufficient irrigation to prevent severe wilt.

In June 1997 and 1998, a single application of Tilwa wetting agent (Turftech International Ltd.) was applied to the plots at 16 ounces per 1,000 square feet. Turfgrass color, quality and root growth were monitored from June to October in both years. Volumetric water content of the top 2 inches of the soil profile was determined 24 hours after applying approximately ½ inch of water. This was done

More Info: www.gcsaa.org

- Summer stress accompanied by water-repellent soil leads to significant declines in bentgrass root growth, which may lead to localized dry spots in turf.
- Test plots treated with wetting agents showed improved soil moisture and enhanced bentgrass root growth compared to control plots.
- Because the presence and severity of hydrophobic soil vary across a putting green, treating the entire green may be more beneficial than simply spot-treating the apparent hot spots.

Key points

periodically throughout the study. The wetting-agent treatment and control were replicated four times, and the data were statistically analyzed.

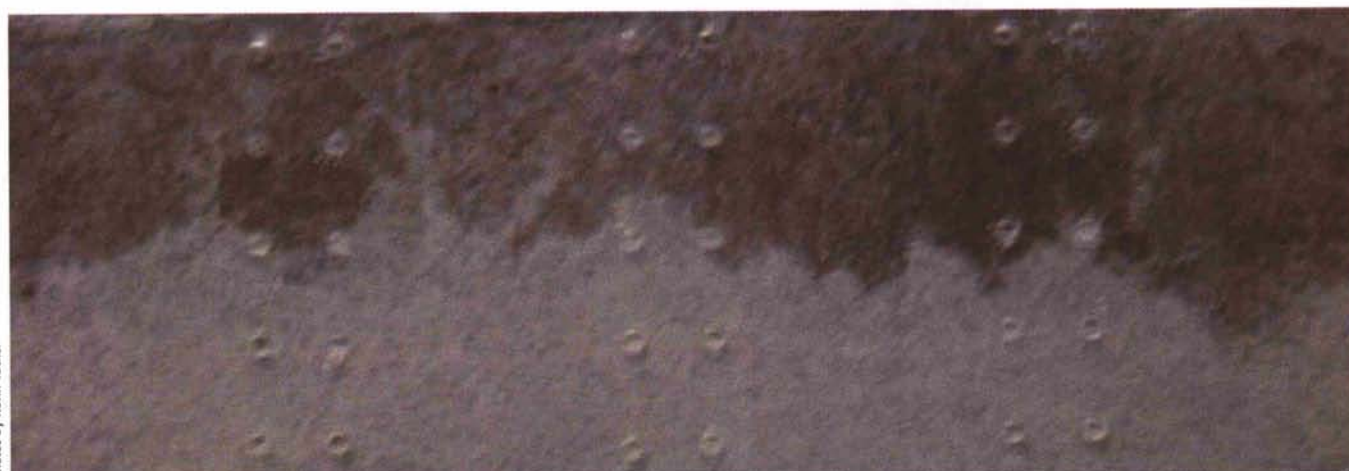
Results

Although both the wetting-agent and control plots were irrigated to avoid serious wilt, of the 36 color and quality measurements taken during both years of the study, the wetting-agent treatment significantly improved turfgrass color and quality 78 percent of the time. Likewise, soil-moisture content of the plots treated with the wetting agent averaged more than twice the level measured in the control plots 24 hours after irrigation (8.3 percent versus 3.5 percent). Soil-water repellency was significantly reduced for up to 12 weeks after

wetting-agent application. Before wetting-agent application, total root length was not significantly different for the wetting-agent and control plots.

Root-length data pooled for June, July and August of both years showed a significant response to the wetting-agent treatment. The wetting-agent treatments resulted in a 27 percent increase in root length at the 0- to 3-inch depth. This, of course, was the zone in which the hydrophobic soil was placed and the zone of greatest root growth for creeping bentgrass maintained under putting green conditions.

At the 3- to 6-inch depth, root length in the wetting-agent treatment was not significantly different from that of the control. This isn't too surprising because this zone did not contain



Photos by Kevin Tucker

Top: Hydrophobic soil profile not treated with a wetting agent. Note the nonuniform wetting. Bottom: Hydrophobic soil profile treated with a wetting agent. Note the uniform wetting front.

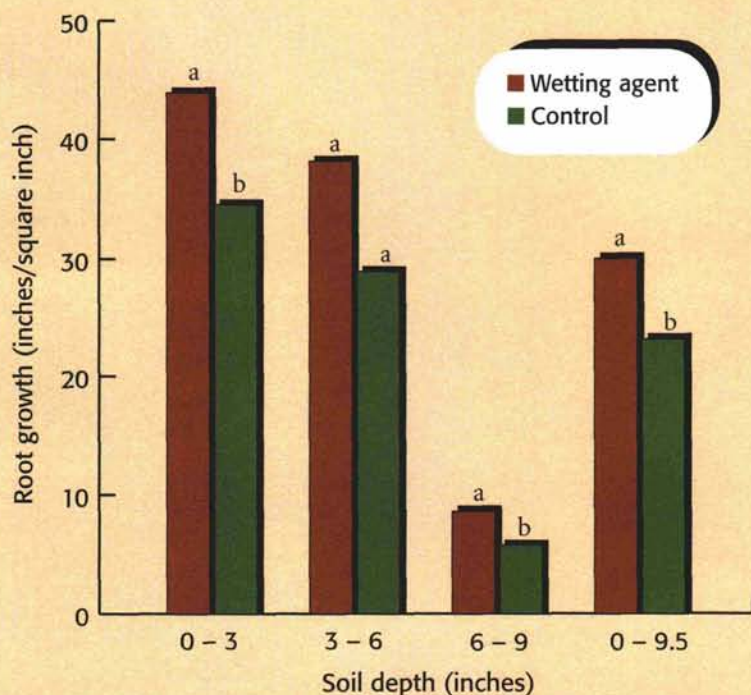
hydrophobic soil. It is well documented that hydrophobic soil is primarily found in the upper 2 inches of the soil profile, and typically the occurrence and severity of water repellency decrease substantially below the top 2 inches. It is important to note, however, that compared to the control, treatment with a wetting agent resulted in a 30 percent increase in root length for all depths combined (0 to 9.5 inches).

Conclusions

The results of this study show that hydrophobic soil treated with Tilwa wetting agent during summer stress can improve color, quality and root growth of creeping bentgrass. Are these results unique to the wetting agent used in this study? Similar results have been obtained with Lescoflo (Lesco Inc.) and a new formulation of Tilwa. We have not evaluated other wetting agents in this way.

Although it would appear that the results are due to improved soil moisture conditions, the literature suggests that certain surfactants and related materials can affect the physiology of the plant. In any case, it is important to note that, regardless of the wetting agent used, the observed positive effects occurred *before* the turfgrass exhibited severe signs of LDS, indicating that even moderate moisture stress (perhaps not visible to the human eye) can significantly affect root growth. Because the presence and severity of hydrophobic soil vary across a putting green, these results suggest that treating the entire green may be more beneficial than simply spot-treating the apparent LDS or hot spots as is sometimes done. Treating the entire green would help minimize variability in wetting and drying of the soil profile, particularly the top 2 inches, thus resulting in more-uniform and consistent root growth and shoot quality during the summer and early fall months.

Effect of a wetting agent on root growth



Compared to a control treatment, treatment with a wetting agent increased Penncross root growth. Column pairs with different letters are statistically different at the 0.05 level. The last pair of columns (0-9.5) shows the combined results for all soil depths.

References

1. Carrow, R.N. 1996. Summer decline of bentgrass greens. *Golf Course Management* 64(6): 51-56.
2. Karnok, K., and M. Beall. 1995. Localized dry spots caused by hydrophobic soil: What have we learned? *Golf Course Management* 63(8):57-59.
3. Karnok, K.J., and K.A. Tucker. 1999. Dry spots return with summer. *Golf Course Management* 67(5):49-52.
4. Karnok, K.J., and K.A. Tucker. 2000. FAQ about LDS. *Golf Course Management* 68(6):75-78.
5. Tucker, K.A., K.J. Karnok, D.E. Radcliffe, G. Landry Jr., R.W. Roncadori and K.H. Tan. 1990. Localized dry spots as caused by hydrophobic sand on bentgrass greens. *Agronomy Journal* 82:549-555.
6. Karnok, K.J., E.J. Rowland and K.H. Tan. 1993. High pH treatments and the alleviation of soil hydrophobicity on golf greens. *Agronomy Journal* 85:983-986.
7. Wilkinson, J.F., and R.H. Miller. 1978. Investigation and treatment of localized dry spots on sand golf greens. *Agronomy Journal* 70:299-304.

Keith J. Karnok, Ph.D., is a professor of turfgrass science in the department of crop and soil sciences at the University of Georgia. Kevin A. Tucker is a research associate in the department.