Wetting Agents Provide Ways to Manage Summer Stress of Bentgrass in the Transition Zone

By W.G. Sarvis, H. Liu, L.B. McCarty, and J.E. Toler

Creeping bentgrass is the most widely used cool-season turfgrass species on putting greens in the United States. When grown on sand-based putting greens, such as those built to United States Golf Association specifications, bentgrass summer decline and occurrence of localized dry spots (LDS) quickly become one of the most overwhelming hurdles for superintendents. The use of wetting agents or soil surfactants has gained recent popularity with turf managers by increasing water infiltration and retention of drought stricken putting greens.

Localized dry spots are thought to be caused by the *Basidiomycete* fungi (McCarty, 2005). As the fungi decompose, they release organic and hydrophobic fulvic and humic acids (Miller and Wilkinson, 1978; Roberts and Carbon, 1972). Localized dry spots are areas several inches to several feet across and irregular or serpentine in shape. They are characterized by having soils that are extremely hydrophobic and very difficult to re-wet upon drying.

Wetting agents have been used to increase water-holding capacity of turfgrass soil media for some time. Wilkinson and Miller (1978) determined the severity of localized dry spot caused by hydrophobic soil can be reduced by improving moisture retention and infiltration when under wetting agent treatments. Karnok and Tucker (2001) reported that one application of a wetting agent significantly reduced the MED (molarity of ethanol droplet, a test for water repellency) of a hydrophobic soil for up to 12 weeks.

The study

A two-year field study was conducted in 2006 and 2007 at Clemson University to evaluate effects of a wetting agent (Revolution by Aquatrols Corp.) and both liquid and granular potassium (K) fertilization on the alleviation of summer stress associated with creeping bentgrass during summer months. Plots were arranged in a randomized split-block design with four replications.

The wetting agent was applied monthly from May to October each year at a rate of 6 ounces per 1,000 square feet (oz/ft^2). Applications of the wetting agent were immediately watered in by hand.

Potassium (K) was supplied to the research plots as either liquid or granular sources. Liquid K was applied every two weeks from May to October each year at 0, 2 pounds, or 4 pounds K/1,000ft^2. Liquid K was applied using a carbon dioxide backpack type sprayer. Granular K was applied at times of aerification; one spring and two fall aerification dates each year. After aerifying and removing cores, a granular K was swept by hand into each plot in order to incorporate fertilizer into soil. Granular K was also supplied at 0, 2 pounds, or 4 pounds K/1,000ft^2 annually.

Parameters measured included leaf and root tissue nutrient concentrations, clipping yield, root weight, volumetric soil water content, soil hydrophobicity using the water droplet method at 1.5-centimeter (cm) and 3-cm depths, and turf quality (TQ). Turf quality was measured on a 1 to 9 scale; 1 being dead turf, 7 being acceptable, and 9 being of optimal turf color and quality.

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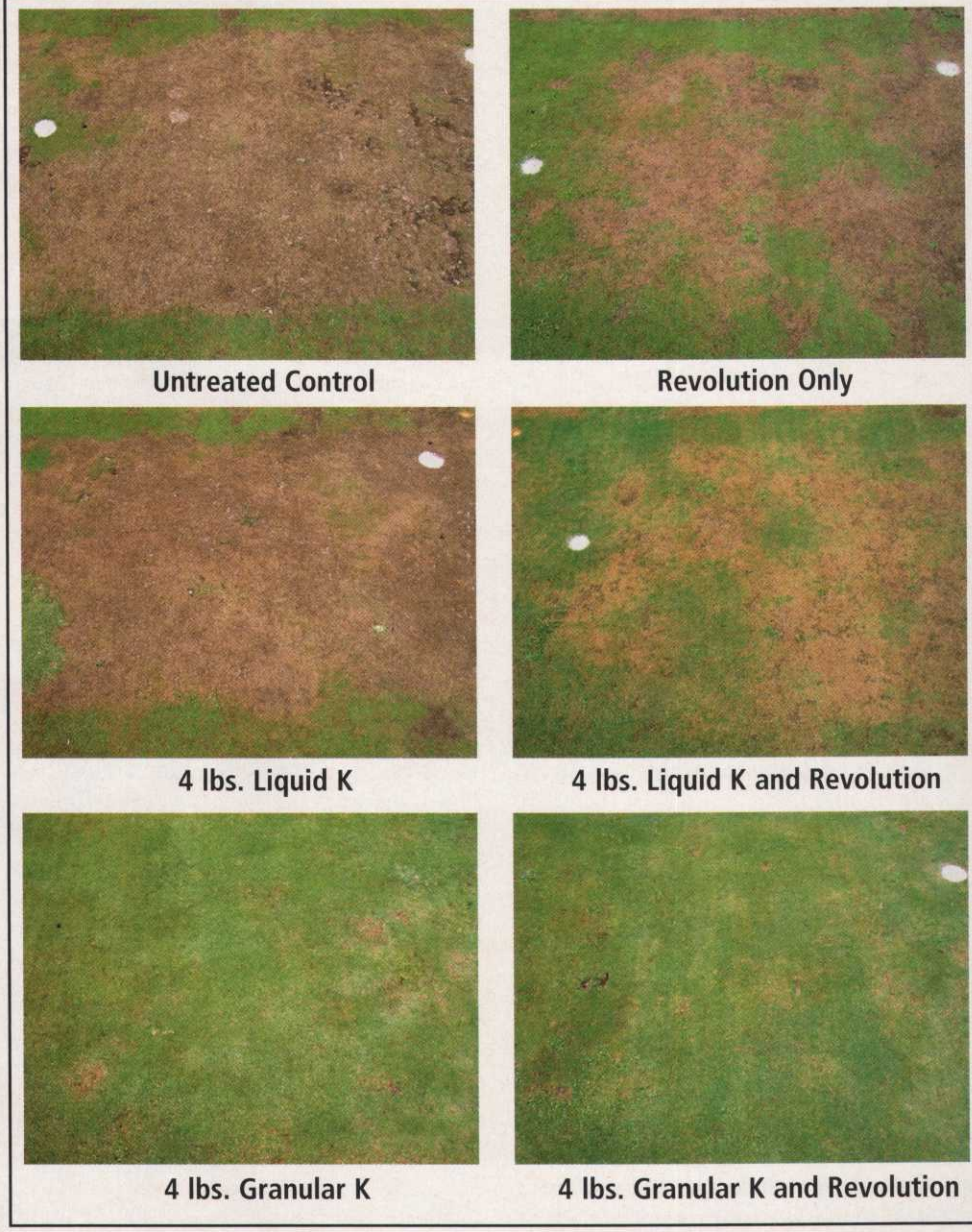
QUICK TIP

Spring is a fast-growing season. However, increased mower noise can be a nuisance to golfers and nearby neighbors. To aid in this problem, opt for a quieter greens mower, such as the John Deere 2500E Hybrid Riding Greens Mower. Sound levels are significantly reduced due to the use of electric-powered cutting units, which also minimize the risk of hydraulic leaks in the reel circuit and improve fuel savings. For more information on greens mowers, visit www.johndeere.com/golf.

FIGURE 1



Soil hydrophobicity of a 85:15 sand-peat mixture as affected by Revolution wetting agent during the summers of 2006-07.

Plots receiving wetting agents showed better turf quality under drought conditions.

For soil hydrophobicity testing, two cores were removed from each plot two weeks after each wetting agent application. Cores were allowed to air dry for four weeks, and a droplet of water was placed at 1.5-cm and 3-cm depths. Time taken for core to fully absorb the droplet was recorded in seconds.

All statistical computations were conducted using the analysis of variance (ANOVA) procedure within the Statistical Analysis System (SAS Institute, 1999). Means were separated using Fisher's Least

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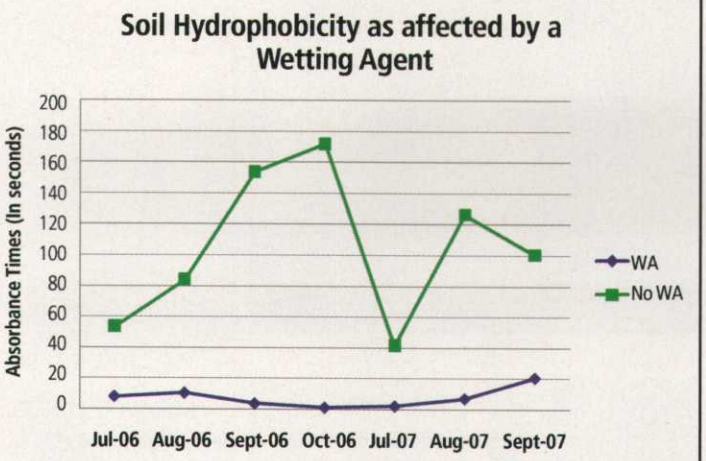
FIGURE 2



Soil hydrophobicity of a 85:15 sand-peat mixture as affected by Revolution wetting agent during the summers of 2006-07.

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Significant Difference (LSD) test at an alpha level of 0.05.

The results

In 2006, the greatest TQ was shown on plots receiving granular K at 4 pounds K/1,000ft² annually and no wetting agent. Interestingly, in 2007, the highest TQ was on plots receiving Revolution and 4 lbs granular K/1,000ft² per year. This change in results from 2006 to 2007 is most likely due to the extreme drought that plagued the southeastern United States during the summer of 2007. In 2006, the plots received 24 inches of rainfall from June to October. In 2007, only 10.4 inches of precipitation was recorded. The wetting agent apparently retained excessive amounts of soil moisture in 2006, preventing nighttime soil cooling. Plots receiving a wetting agent in 2007 demonstrated much better turf quality under drought conditions due to its ability to maintain soil moisture throughout the summer months. The lowest TQ readings were from liquid K treated plots, primarily due to phototoxicity of liquid potassium.

Soil hydrophobicity was significantly reduced at every measurement date in 2006 and 2007 at both the 1.5-cm and 3-cm depths. Also, the soil was found to be less hydrophobic at a depth of 5 cm to 6 cm or lower. Tucker et al. (1990) reported similar findings where hydrophobic soil was confined to the upper 5 cm of soil on a bentgrass putting green.

Clipping yields were not found different among fertility treatments or wetting-agent treatments. However, liquid K-treated plots yielded the highest leaf tissue K concentrations. While spoon-feeding potassium to bentgrass during the summer months led to the highest leaf K concentrations, our study suggests that liquid K fertility can have profound negative effects on turfgrass quality during the hottest summer months.

The results of this study proved interesting for two reasons. First, in 2006, the use of a wetting agents yielded unfavorable results. By retaining high amounts of soil moisture, the wetting agents apparently prevented the cooling down of soil by maintaining excessively high soil temperatures. Secondly, in the drought of 2007, wetting agents applications consistently sustained enough soil moisture to greatly increase turf quality through the summer. Our research suggests that with proper planning and careful use, wetting agents are a valuable tool turf managers can arm themselves with in the battle against bentgrass summer decline.

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Bayer Environmental Science

QUICK TIP

Insect control will soon be top of mind as we move into the summer months. Broadcast-applied TopChoice® insecticide offers outstanding fire ant control, as well as control of mole crickets. Both products deliver the benefits of the active ingredient fipronil at ultra-low doses.