Wetting Agents Decrease Wilt Symptoms and Water Repellency on a Sand-Based Putting Green

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Summary. Localized dry spot (LDS) continues to be a management problem on sand-based golf course putting greens throughout the southern range of creeping bentgrass (*Agrostis palustris* Huds.) adaptation. The commercially available wetting agent, 'Primer Select', applied at label rate, and an experimental product, 'ACA 1820,'applied at three rates, were examined for their effects on reducing LDS symptoms on a sand-based putting green during the 2003 growing season. All wetting agent treatments improved turf quality and reduced wilt symptoms compared to a control treatment. Application of the experimental wetting agent, 'ACA 1820', resulted in slightly less turfgrass wilt and water repellency compared to 'Primer Select'.

Since the 1970s, construction of new golf course putting greens has included sand-based rootzones, primarily because of compaction resistance and rapid drainage. A management problem that has increased with the use of sand-based putting greens is the phenomenon called localized dry spot (LDS). LDS tends to occur within a few years following turfgrass establishment and is characterized by random patches of wilting turf on the surface of the putting green, with water-repellent sand immediately below the wilted turf. At this time, there is no known cure for LDS. Historically, the most effective treatment for LDS has been the application of wetting agents (surfactants), which act as a chemical bridge between hydrophobic sand particles and water. The effectiveness of wetting agents is variable and usually temporary, as they are broken down by microbial action while the water-repellent sand remains. The objective of the following study was to determine the effectiveness of a commercially available wetting agent, 'Primer Select' (Aquatrols Corp., Cherry Hill, NJ), and an experimental product, 'ACA 1820' on treating LDS symptoms.

Materials and methods

Experimental area. The experiment was conducted during the 2003 growing season at the University of Arkansas Research and Extension Center (Fayetteville, Ark.) on an 'SR-1020' creeping bentgrass putting green established in spring 2001 and constructed according to USGA recommendations (USGA, 1993). The green was mowed 6 times per week at a one-eighth inch (3.2 mm) height. The area was fertilized using biweekly foliar applications to apply approximately 0.5, 0.1, and 0.5 lb. of N, P_2O_5, and K_2O, per 1000 ft^2 (0.5 lb per 1000 ft^{-2} = 2.4 $g \cdot m^{-2}$, 0.1 lb per 1000 ft^{-2} = 0.48 $g \cdot m^{-2}$), respectively, per month during active growth. Other nutrients were applied according to soil test recommendations. Irrigation was applied as needed throughout the experiment, typically every 5 to 7 days. To encourage the development of localized dry spots, syringe irrigation was limited during the study. Occasional curative pesticide applications were made to the experimental area to minimize disease and insect damage.

Treatments. Twenty plots measuring 8 by 5 ft (2.43 by 1.52 m) each were arranged in four blocks of five plots each within the experimental area. Each of five wetting agent treatments was applied monthly to four replicate plots, beginning on 10 May. Treatments consisted of ACA 1820 at 2, 4, and 6 oz per 1000 ft^2 (0.64, 1.28, and 1.72 $L \cdot ha^{-1}$), Primer Select applied at a label rate of 6 oz per1000 ft^{-2} (1.72 $L \cdot ha^{-1}$), and a water-only control. Each treatment was applied using a CO_2 powered sprayer in 2.4 gal. water per 1000 ft^{-2} (978 $L \cdot ha^{-1}$). The final treatment applications were made on 10 September.

Evaluations. Turf quality, leaf wilt, and soil moisture were evaluated weekly on each plot, beginning on 8 May and concluding on 17 September, except for soil moisture evaluations, which concluded on 2 October. Turf quality was rated on a 1 to 9 scale, with 9 representing ideal, dark green, dense, uniform turf, 6 representing minimum acceptable quality, and 1 representing dead turf. Leaf wilt was evaluated by visually estimating the percent wilt occurring within each plot. Soil moisture was evaluated with a TDR probe (Model TRIME FM, Mesa Systems Co, Medfield, MA) by averaging five readings that were sampled randomly within each plot. Water drop penetration times were evaluated on soil cores extracted from each plot immediately prior to each monthly treatment application. Five soil cores per plot were collected, air-dried at room temperature for two weeks, and sectioned into 0, 1, 2, 3, 4, 5, and 6 cm rootzone depths for water drop penetration testing. A 40 µL water droplet was placed on each sample at each depth and the time elapsed until complete penetration into the rootzone was recorded. Water droplets still remaining after 600 sec. were recorded and discarded.

Statistical analysis. For each evaluation parameter, an analysis of variance was computed to determine if wetting agent, date, and wetting agent x date effects were significant ($P < 0.05$). When significant, means were separated according to Fisher's least significant difference test ($P < 0.05$). Since multiple measurements were taken on each plot over time, the data were analyzed as a repeated measures experiment, using PROC MIXED of SAS v. 8.02.

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Results and discussion

Turf Quality. Turf quality data during the 2003 growing season are summarized in Fig 1. The main effects of wetting agent and rating date were both significant in 2003. When averaged across evaluation dates, all wetting agent treatments had equal turf quality and significantly better turf quality than the control (data not shown). Significant differences among treatments were present on 21 August, and 11 and 17 September. On 21 August, 'ACA 1820' (6oz/1000ft^2) and 'Primer Select' had significantly higher quality than 'ACA 1820' (2oz/1000ft^2) and the control. On 11 and 17 September, all wetting agents treatments did not differ in quality, but had significantly higher quality than the control.

Turf Wilt. Turf wilt data during the 2003 growing season are summarized in Fig 2. Treatment, date, and treatment x date effects were all highly significant. From 3 July to 21 August, there were significant treatment differences in turf wilt on all but two rating dates (10 and 24 July). Before and after this period, there were no differences among treatments with regard to turfgrass wilt. On dates where significant wilting was present, the control treatment consistently had the highest amount of wilt, while 'ACA 1820' (6oz/1000ft^2) was the only wetting agent treatment that always had significantly less wilt than the control. When averaged across rating dates, all wetting agent treatments had equal turf wilt, but significantly less wilt than the control (data not shown).

Soil Moisture. Soil moisture was not significantly affected by wetting agent treatments during the 2003 growing season, however, there was a significant date effect. Soil moisture values ranged from an average low of 7.4 percent on 17 September to an average high of 13.1 percent on 5 June.

Water Drop Penetration Time. The effects of depth, date, treatment x date, and depth x date were all significant regarding water drop penetration time (WDPT). The thatch/soil interface was the only depth at which wetting agent treatments significantly affected water drop penetration time. Water drop penetration time data at the thatch/soil interface are summarized in Fig 3. At this depth, there were significant differences among wetting agents on 9 Aug. and 9 Sept. On 9 August, the control and 'ACA 1820' (2oz/1000ft^2) treatments had significantly longer water drop penetration times than the other three wetting agent treatments. By 9 September, all wetting agent treatments had significantly lower WDPT than the control.

Conclusions

All wetting agent treatments improved the overall quality of putting green turf during the 2003 growing season. Although the commercially available product, Primer, decreased turf wilt and water repellency at the thatch/soil interface when compared to the control, the experimental product, 'ACA 1820', when applied at 4 or 6 oz per 1000 ft^2 (1.28, and 1.72 L•ha^{-1}) reduced these symptoms associated with localized dry spot even further. Currently, it has not been determined when this product will become commercially available. The treatment and cure of localized dry spot will continue to remain a central focus for the University of Arkansas turfgrass research program.

Literature cited

USGA. 1993. USGA recommendations for putting green construction. USGA Green Section Record. 31(2):1-3.

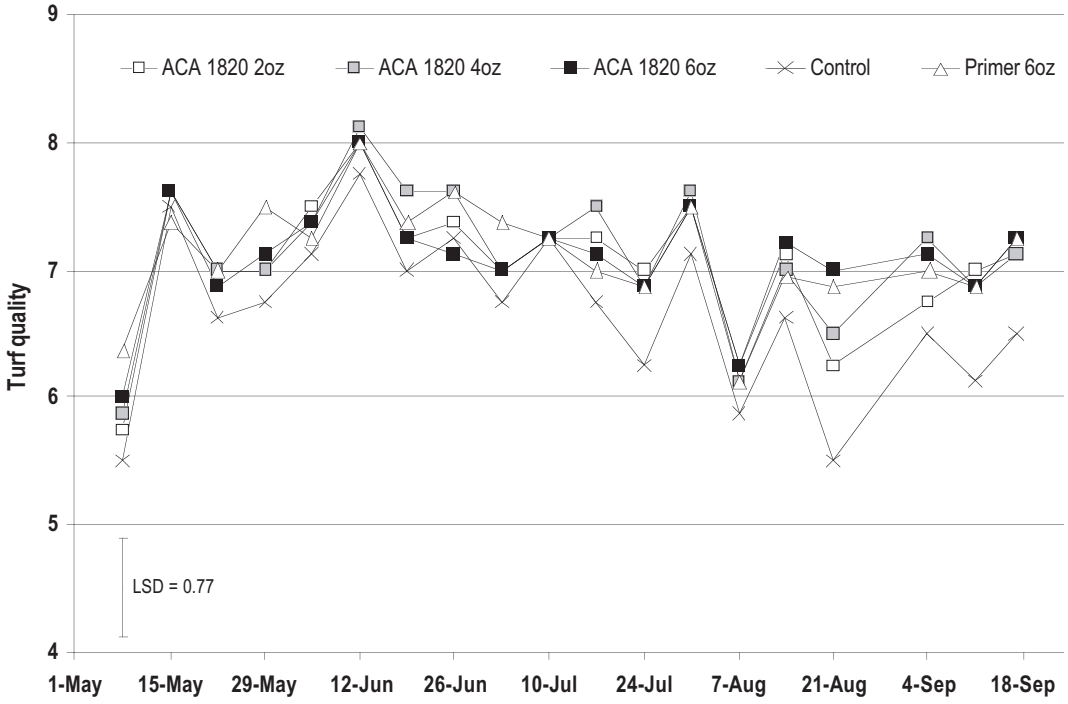

Fig. 1. Turfgrass quality ratings during the 2003 growing season as effected by wetting agent treatment. 9 = ideal, dark green, dense, uniform, fine-textured turf, 1 = dead turf.

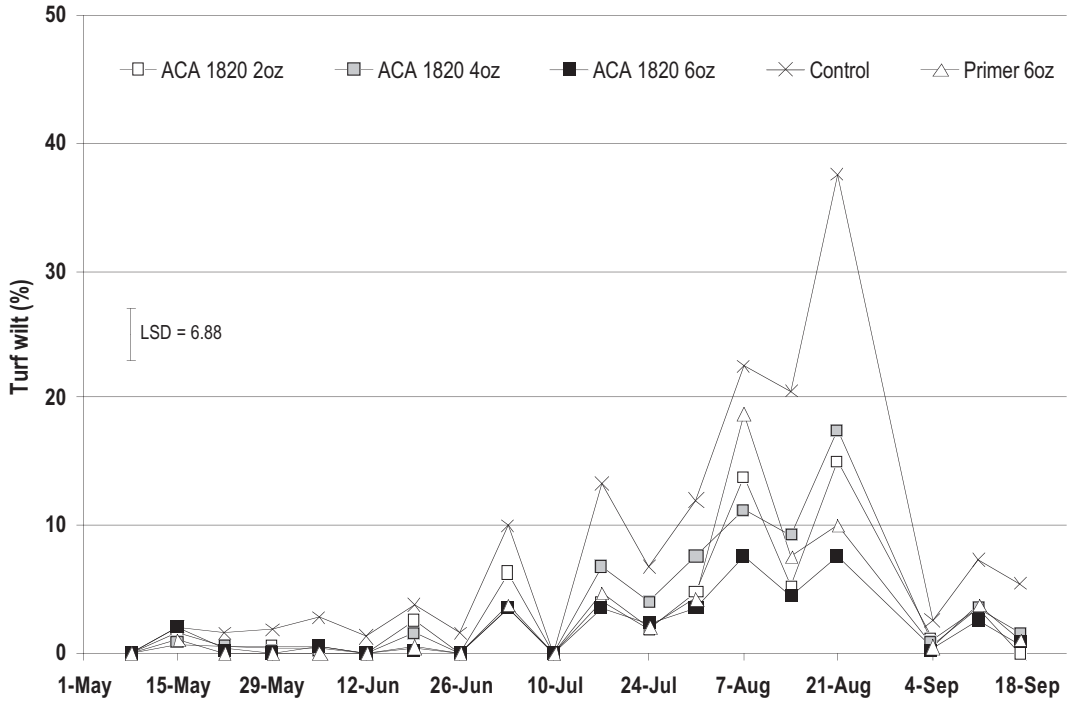

Fig. 2. Percent turf wilt during the 2003 growing season as effected by wetting agent treatment.

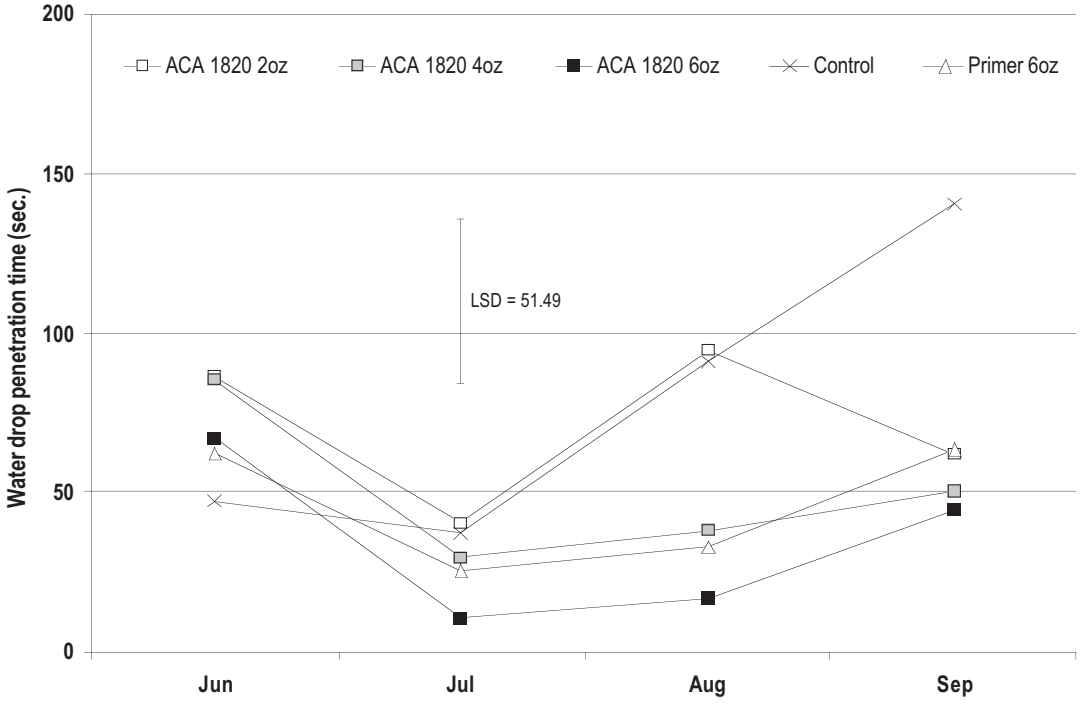

Fig. 3. Water drop penetration times at the thatch/soil interface during the 2003 growing season as effected by wetting agent treatment.