

Evaluation of Various Aquatrols Wetting Agents for Suppression of Localized Dry Spot and Hydrophobicity on a Sand-based Rootzone, 2003

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Objective:

To evaluate the effectiveness of two commercially available wetting agents and an experimental product at three rates for the suppression of localized dry spot (LDS) on an experimental sand-based rootzone.

How it Was Done:

Wetting agent products were applied with a pressurized CO₂ (32 psi) sprayer equipped with a flat-fan nozzle 8010E and calibrated to deliver 2.5 gallons of water per 1000 sq ft. All treatments were initiated on 9 May, 2003 and re-applied on either a 28 or 90 day interval, dates and rates of product application are footnoted in the data tables. Following the application of all treatments the plots were irrigated with a minimum of 0.25 inches of water via an overhead sprinkler system. The rootzone in the study area was a six year old sand-based rootzone that conformed to USGA size guidelines and contains peat moss. Turf was creeping bentgrass 'Pennlinks' maintained at 0.150 inches by daily mowing and fertilized with approximately 3.0 lbs. of N/1000 sq ft. throughout the growing season. Plots were 6 ft x 6 ft, and arranged in a randomized complete block with four replications. Throughout the study the plots were only irrigated to prevent severe summer stress.

During the study the plots were rated visually for overall turfgrass quality, injury, and percentage area affected by LDS. Turfgrass quality was assessed on a 0 to 10 scale where 0 equals brown or dead turf and 10 equals optimal greenness, density and uniformity. Injury was rated on a 0 to 5 scale where 0 equals no injury and 5 equals entire plot area brown. Percent of plot area affected by localized dry spot was assessed on a linear 0 to 100 % scale where 0 = entire plot area green and healthy, and 100 = entire plot area affected. Rootzone water contents were recorded throughout the study using a Dynamax Theta Probe which measures the volumetric water content of the rootzone to a depth of 2.36 inches from the surface. Five measurements per plot were recorded for each observation date. The ability of the wetting agents to improve and/or sustain the wettability of the rootzone media with depth (0 to 6 cm) was determined on a 28 day interval using the water droplet penetration test. Severity of hydrophobicity was judged based on the following scale of water droplet penetration: 0-5 sec = wettable, 6-60 secs = slightly hydrophobic, 61-600 sec = strongly hydrophobic, and > 600 sec = water repellent.

Results to Date:

Turfgrass quality and injury were visually assessed throughout the study (Tables 1 and 2). There were no quality differences among the plots at the beginning of the study and treatment differences were rarely observed throughout the study. Quality of the Sixteen90 treated plots, however, was significantly lower after the initial application on 9 May, which caused minor discoloration and an unacceptable level of yellowing that was noticeable for almost 21 days (Table 2). Treatment with Primer Select and ACA 1820 at 4.0 or 6.0 oz per 1000 sq ft. also yellowed the turf but only slightly, which was noticeable for 5 days after application. No other major discoloration due to sequential applications was

observed throughout the study for the 28 day interval products. A similar significant discoloration also occurred following the repeat 90-day application of Sixteen90 on 4 Aug. This discoloration did not cause a reduction in quality compared to other treatments.

From 27 to 30 June, there was a relatively large, >10 % plot area affected, incidence of LDS observed in the plots treated with ACA 1820 2.0 or 4.0 oz (Table 3). These differences, however, were not statistically significant. By, 10 July, following a significant rainfall event (>10 inches), all plots recovered and the amount of LDS in any treatment never exceeded 3.8 % plot area affected for the remainder of the study. The presence of relatively low LDS during the summer was most likely due to the uncharacteristic and excessive rainfall that West Lafayette received during the months of late-June through July (> 15 inches). Slight treatment differences due to the wetting agents were detected during the month of Aug., but the differences were rather small (< 1%) and probably not agronomically important.

The water contents of the rootzone ranged from 9 to 25 % moisture throughout the course of the study (Table 4). The average rootzone water content steadily remained 10-15% from 16 June to 30 June, which would likely promote the occurrence of LDS in a sand rootzone. By 7 July, however, rootzone water contents were above 19 % and remained at that level throughout July and most of Aug., primarily due to rainfall additions. Treatment differences were rarely detected, except from 21 to 25 July and on 11 Aug. when the water content of non-treated plots was significantly lower, approximately 2 %, than wetting agent treated plots. Seasonal average water contents for all treatments ranged from approximately 16 to 18 % but no seasonal treatment differences were observed.

Prior to wetting agent applications on 9 May, all plots were sampled to determine background levels of rootzone water repellence. There were no differences, and all plots displaying a uniform level of water repellence (Table 5). The highest degree of water repellence was observed at the one and two cm depths (ranging from 340 to 690 sec) and the least at the five and six cm depths (12 sec or less). Water repellence ratings for the 1 cm depth would be classified as strongly hydrophobic to water repellent in some cases, thus the application of a wetting agent on this rootzone would be warranted. One month following application of all treatments, 6 June, significant treatment differences were observed across the zero to four cm depths with the most noticeable differences occurring at the zero to two cm depths. Untreated plots had water repellency ratings of 322 to 460 seconds across these depths, while plots treated with wetting agents lowered these values down to 18 to 105, 53 to 338, and 126 to 297 seconds for the zero, one and two cm depths respectively. The biggest difference resulted from the Sixteen90 product which performed significantly better than all other wetting agents at the one and two cm depth. On the 1 July sampling date significant treatment differences were only observed at the surface depth, zero cm, and the low rate, 2.0 oz per 1000 sq ft., of ACA 1820 was similar to the untreated plots. A similar trend was observed for the 14 Aug. sampling date with the lower rates, 2.0 and 4.0 oz, of ACA 1820 not being different from the untreated plots at the one cm depth. It is interesting to note that the values for the untreated plots across the top three depths would be classified as water repellent, > 600 sec, for this rating date and a wetting agent would probably be required to alleviate this

condition. A trend for increasing hydrophobicity values occurred across the dates for the Sixteen90 product at the top three sampling depths. This would be expected because of this products single application early in the season. In summary, no treatment consistently reduced LDS incidence or severity, nor did any treatment improve the overall water content of the rootzone. The inability of these products to significantly improve turfgrass quality or LDS incidence was unexpected but was likely due to unusual environmental factors, specifically uncharacteristically wet and cool summer conditions. All wetting agent products and rates, however, were effective at decreasing the hydrophobicity of the rootzone media to varying degrees throughout the study. The largest effect was noticed in the top zero to two cm. Although a single application product like Sixteen90 reduces hydrophobicity of the upper rootzone depths the potential for turfgrass discoloration is probably not worth the risk.

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Table 1. Visual quality of 'Pennlinks' creeping bentgrass grown on a sand-based rootzone as influenced by various Aquatrols wetting agent applications, 2003.
Quality rating

Treatment ^a	Rate oz / 1000 ft ²	Quality rating								
		15 May	21 May	30 May	7 June	18 June	25 June	27 June	30 June	10 July
		----- (0-10 scale) ^b -----								
Primer Select	4.0	8.9 a ^c	8.8 a	9.0 a	8.5 a	8.5 a	7.8 a	8.0 a	8.0 a	7.7 a
ACA 1820	2.0	8.9 a	8.6 a	9.0 a	8.5 a	8.3 a	7.6 a	7.3 a	7.1 a	7.4 a
ACA 1820	4.0	8.8 a	8.9 a	9.0 a	8.5 a	8.5 a	7.5 a	7.2 a	7.3 a	7.5 a
ACA 1820	6.0	8.7 a	8.6 a	8.9 a	8.4 a	8.5 a	7.8 a	7.8 a	7.8 a	7.7 a
Sixteen 90 ^c	16.0	7.3 b	7.1 b	8.6 b	8.5 a	8.5 a	7.9 a	7.8 a	7.8 a	7.8 a
Untreated	---	8.7 a	8.8 a	9.0 a	8.5 a	8.3 a	7.7 a	7.9 a	7.7 a	7.5 a

Treatment ^a	Rate oz / 1000 ft ²	Quality rating							
		18 July	22 July	29 July	14 Aug.	18 Aug.	27 Aug.	2 Sept.	9 Sept.
		----- (0-10 scale) ^b -----							
Primer Select	4.0	7.7 a	8.3 a	8.6 a	8.5 a	8.0 a	7.5 a	8.2 a	8.1 a
ACA 1820	2.0	7.7 a	8.1 a	8.5 a	8.4 a	7.9 a	7.7 a	8.3 a	8.1 a
ACA 1820	4.0	7.7 a	8.5 a	8.6 a	8.5 a	8.0 a	7.6 a	8.2 a	8.1 a
ACA 1820	6.0	7.6 a	8.5 a	8.6 a	8.6 a	8.0 a	7.8 a	8.3 a	8.1 a
Sixteen 90	16.0	7.7 a	8.3 a	8.8 a	8.3 a	7.9 a	7.7 a	8.2 a	8.1 a
Untreated	16.0	7.6 a	8.2 a	8.6 a	8.2 a	8.0 a	7.6 a	8.1 a	8.0 a

^a All treatments were initiated on 9 May, 2003 and re-applied on 7 June, 1 July, and 4 August except for Sixteen 90 which was re-applied on 11 August only, all treatments were applied in 2.5 gal water per 1000 ft² and irrigated immediately after application with 0.25 inches of water.

^b Visual turfgrass quality is based on a scale of 0 to 10 where 0 is brown, dead turf and 10 is dark green ideal turf; acceptable quality ≥ 7.5 .

^c Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 2. Creeping bentgrass ‘Pennlinks’ injury as influenced by various Aquatrols wetting agent applications, 2003.

Treatment ^a	Rate oz / 1000 ft ²	Injury							
		11 May	14 May	21 May	30 May	12 Aug.	14 Aug.	18 Aug.	27 Aug.
		----- (0-5 scale) ^b -----							
Primer Select	4.0	0.4 ab ^c	0.1 b	0.0 b	0.0 b	0.1 a	0.0 a	0.0 b	0.0 b
ACA 1820	2.0	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	0.0 a	0.0 b	0.0 b
ACA 1820	4.0	0.1 b	0.0 b	0.0 b	0.0 b	0.0 a	0.0 a	0.0 b	0.0 b
ACA 1820	6.0	0.3 b	0.1 b	0.0 b	0.0 b	0.1 a	0.0 a	0.0 b	0.0 b
Sixteen 90	16.0	0.6 a	0.6 a	0.6 a	0.2 a	0.2 a	0.1 a	0.6 a	0.1 a
Untreated	---	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	0.3 a	0.1 b	0.0 b

^a All treatments were initiated on 9 May, 2003 and re-applied on 7 June, 1 July, and 4 August except for Sixteen 90 which was re-applied on 11 August only, all treatments were applied in 2.5 gal water per 1000 ft² and irrigated immediately after application with 0.25 inches of water.

^b Injury was visually rated on a scale of 0 to 5 where 0 is brown, dead turf and 5 is dark green ideal turf.

^cMeans in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 3. Localized dry spot severity in ‘Pennlinks’ creeping bentgrass grown on a sand-based rootzone as influenced by various Aquatrols wetting agent applications, 2003.

Treatment ^a	Rate oz / 1000 ft ²	Localized dry spot rating						
		25 June	27 June	30 June	10 July (0-100 %) ^b	29 July	14 Aug.	27 Aug.
Primer Select	4.0	0.2 a ^c	3.8 a	0.8 a	0.1 a	0.1 ab	0.0 b	0.0 b
ACA 1820	2.0	7.5 a	12.5 a	12.5 a	3.8 a	0.3 ab	0.0 b	0.5 ab
ACA 1820	4.0	5.0 a	11.5 a	12.5 a	3.8 a	0.0 b	0.0 b	0.5 ab
ACA 1820	6.0	1.0 a	4.0 a	0.8 a	0.1 a	0.0 b	0.0 b	0.1 ab
Sixteen 90	16.0	0.8 a	3.8 a	0.3 a	0.2 a	0.1 ab	0.1 ab	0.5 ab
Untreated	---	2.3 a	8.8 a	1.2 a	0.2 a	0.8 a	0.6 a	1.0 a

^a All treatments were initiated on 9 May, 2003 and re-applied on 7 June, 1 July, and 4 August except for Sixteen 90 which was re-applied on 11 August only, all treatments were applied in 2.5 gal water per 1000 ft² and irrigated immediately after application with 0.25 inches of water.

^b Localized dry spot was visually assessed on a 0 to 100 % scale where 0 = no LDS observed and 100 is entire plot affected.

^cMeans in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 4. Rootzone water contents of a sand-based rootzone as influenced by various Aquatrols wetting agent applications, 2003.

		Volumetric water content										
Treatment ^a	Rate	16 June	23 June	25 June	27 June	30 June	7 July	11 July	21 July	25 July	30 July	1 Aug.
	oz / 1000 ft ²	----- (%) ^b -----										
Primer Select	4.0	15.7 a ^c	13.9 a	10.5 a	13.3 a	14.3 a	20.9 a	16.6 a	20.9 ab	17.4 a	19.9 a	20.3 a
ACA 1820	2.0	15.8 a	14.4 a	11.6 a	13.2 a	14.6 a	20.8 a	16.2 a	21.5 a	17.3 a	20.0 a	19.9 a
ACA 1820	4.0	15.6 a	12.9 a	10.1 a	13.3 a	13.3 a	20.2 a	16.3 a	20.8 ab	17.2 a	19.6 a	19.8 a
ACA 1820	6.0	15.9 a	14.9 a	11.7 a	14.3 a	15.6 a	21.1 a	17.4 a	21.1 ab	17.7 a	20.4 a	20.2 a
Sixteen 90	16.0	14.8 a	12.0 a	9.1 a	13.7 a	14.3 a	20.9 a	16.4 a	21.0 ab	16.8 a	19.7 a	19.4 a
Untreated	---	15.0 a	13.7 a	10.9 a	12.7 a	13.2 a	19.0 a	14.6 a	18.4 b	14.8 b	17.8 a	17.8 a

Treatment ^a	Rate	5 Aug.	11 Aug.	15 Aug.	18 Aug.	20 Aug.	22 Aug.	28 Aug.	8 Sept.	12 Sept.	Season
	oz / 1000 ft ²	----- (%) ^b -----									
Primer Select	4.0	24.5 a	20.4 a	21.3 a	20.0 a	18.6 a	16.9 a	17.0 a	16.4 a	15.6 a	17.7 a
ACA 1820	2.0	24.9 a	20.8 a	20.9 a	19.9 a	19.9 a	18.1 a	16.9 a	17.3 a	15.6 a	18.0 a
ACA 1820	4.0	23.9 a	20.1 a	21.4 a	19.8 a	19.1 a	16.9 a	16.3 a	16.4 a	15.2 a	17.4 a
ACA 1820	6.0	25.1 a	20.8 a	21.3 a	20.2 a	20.4 a	17.7 a	17.7 a	17.2 a	16.2 a	18.3 a
Sixteen 90 ^c	16.0	23.5 a	20.5 a	20.8 a	19.6 a	18.8 a	16.3 a	15.6 a	15.6 a	14.3 a	17.1 a
Untreated	16.0	21.4 a	18.4 b	21.2 a	19.8 a	20.2 a	16.6 a	16.1 a	16.5 a	14.9 a	16.6 a

^a All treatments were initiated on 9 May, 2003 and re-applied on 7 June, 1 July, and 4 August except for Sixteen 90 which was re-applied on 11 August only, all treatments were applied in 2.5 gal water per 1000 ft² and irrigated immediately after application with 0.25 inches of water.

^b Water contents are the means of five measurements per plot averaged across a depth of 2.36 inches.

^c Means in the same column followed by the same letter are not significantly different according the LSD t-test (p=0.05).

Table 5. Water droplet penetration into soil cores of a sand-based rootzone as influenced by various Aquatrols wetting agent applications, 2003.

Treatment ^a	Rate (oz / 1000 ft ²)	Soil depth (cm)						
		0	1	2	3	4	5	6
		----- (seconds) ^b -----						
May 9								
Primer Select	4.0	383 a ^c	691 a	525 a	118 a	57 a	10 a	3 a
ACA 1820	2.0	232 a	477 a	346 a	137 a	19 a	6 a	2 a
ACA 1820	4.0	295 a	538 a	462 a	127 a	31 a	5 a	1 a
ACA 1820	6.0	191 a	556 a	447 a	276 a	27 a	4 a	2 a
Sixteen 90	16.0	247 a	537 a	473 a	191 a	60 a	12 a	5 a
Untreated	---	291 a	580 a	506 a	192 a	33 a	7 a	2 a
June 6								
Primer Select	4.0	52 a	338 b	296 b	139 a	22 ab	6 a	3 a
ACA 1820	2.0	105 a	326 b	293 b	96 abc	12 a	5 a	3 a
ACA 1820	4.0	85 a	277 b	297 b	112 ab	42 b	8 a	3 a
ACA 1820	6.0	54 a	269 b	273 b	62 ab	13 a	4 a	2 a
Sixteen 90	16.0	18 a	53 a	126 a	37 a	10 a	6 a	3 a
Untreated	---	322 b	460 b	461 c	99 ab	29 ab	9 a	5 a
July 1								
Primer Select	4.0	15 a	156 a	354 a	192 a	52 a	8 a	5 a
ACA 1820	2.0	76 ab	428 a	373 a	90 a	15 a	12 a	4 a
ACA 1820	4.0	26 a	218 a	377 a	250 a	76 a	14 a	5 a
ACA 1820	6.0	15 a	127 a	229 a	111 a	21 a	9 a	4 a
Sixteen 90	16.0	51 a	120 a	203 a	170 a	77 a	24 a	9 a
Untreated	---	157 b	387 a	367 a	239 a	69 a	36 a	15 a
Aug 14								
Primer Select	4.0	146 a	255 a	503 a	263 a	22 a	13 a	10 a
ACA 1820	2.0	204 a	593 b	508 a	239 a	56 a	13 a	9 a
ACA 1820	4.0	108 a	455 ab	469 a	101 a	21 a	12 a	6 a
ACA 1820	6.0	86 a	267 a	403 a	156 a	35 a	17 a	6 a
Sixteen 90	16.0	270 a	302 a	419 a	165 a	29 a	12 a	9 a
Untreated	---	688 b	698 b	644 a	332 a	138 b	35 a	11 a

^a All treatments were initiated on 9 May, 2003 and re-applied on 7 June, 1 July, and 4 August except for Sixteen 90 which was re-applied on 11 August only, all treatments were applied in 2.5 gal water per 1000 ft² and irrigated immediately after application with 0.25 inches of water.

^b Water droplet penetration times are the means of four replications with five sub-samples per plot.

^c Means in the same column within each date followed by the same letter are not significantly different according the LSD t-test (p=0.05).