What's Challenging You Now?

Research In Turf Managment You can Use Today

2011 Wetting Solution Study and Analysis

By: Aaron Johnsen & Kevin Leeper (WinField Solutions, LLC) and Dr. Brian Horgan (University of Minnesota)

A lack of water or the existence of excess water can lead to poor turf quality. Wetting agents or surfactants are used to combat localized dry spots, retain water in the soil, and move water though the soil. Wetting agents are composed of a polar head and non-polar tail. The non-polar tails are greatly attracted to water repelling surfaces, such as soil particles. The polar heads attract water. This action allows water to be held by the soil and ultimately be taken up by the plant (Karnok et al, 2004). Wetting agents can be classified into four primary groups; anionic, cationic, nonionic, and amphoteric. Anionic and cationic surfactants generally treat just the water. Most wetting agent products on the market are nonionic surfactants (Karnok et al, 2004). Block polymer nonionic surfactants treat both the water and the soil; therefore, these are the most common wetting agents used on golf courses. The strengths of block polymer nonionic surfactants include adhesion to soil particles, excellent re-wetting capabilities, and plant safety in a wide range of weather conditions. The downside of block polymer nonionic surfactants is they do not reduce the surface tension of water as well as anionic and cationic surfactants (Kostka, 2005).

Research has demonstrated increased soil moisture and soil moisture uniformity from the application of wetting agents (Karcher et al, 2010). Other work on soil columns has shown that two wetting agents influenced soil moisture content differently (Leinauer et al, 2001). This work and most other wetting agent research have been conducted on research putting greens. Little work has been done to see if greens on the same course respond similarly to a wetting agent application and if a wetting agent causes similar results on multiple courses. The objectives of this research were to (1) evaluate soil moisture response to wetting agent applications and (2) determine if a reduction in localized dry spot occurred following wetting agent applications.

Participating Sites and Superintendent

Minnesota Valley Country Club, Mike Brower
North Oaks Golf Club, Jack MacKenzie
Somerby Golf Club, Eric Counselman
Somerset Country Club, James Bade
Southview Country Club, Jeramie Gossman
The Minikahda Club, Jeff Johnson
University of Minnesota Golf Course, Brent Belanger
Bracketts Crossings, Tom Proshek
Burl Oaks Golf Club, Tom Natzel
Dacotah Ridge Golf Course, Aaron Johnson
Keller Golf Course, Paul Diegnau
La Crosse Country Club, Jack Tripp
Medina Golf and Country Club, Erin McManus
Midland Hills Country Club, Mike Manthey

Table 1: 2010 Products tested

	Tricure™	Tournament Ready®	Immerse GT	APSA-80®	Dispatch®	
	Mitchell Products	Kalo, Inc.	AmegA Sciences	Amway	Aquatrols	Aquatrols
# of Courses	2	1	1	2	1	5
Rate per 1000 sq ft	1 & 2 fl oz	6 fl oz	3 fl oz	2 fl oz	.37 fl oz	6 fl oz
Active Ingredient	100% Block Polymer	100% Gluco Ether, Block Polymer Blend	100% Active Ingredient	80% Non-ionic Surfactant	51% Gluco Ether, Block Polymer Blend	100% Modified Block Polymer

Table 2: 2011 Products tested

	Tricure™	Performa Gold	Magnus™	APSA-80®	H30™	
	Mitchell Products	WinField Solutions	Precision	Amway	Spindler Enterprises, Inc.	Aquatrols
# of Courses	3	1	1	1	1	4
Rate per 1000 sq ft	1 & 2 fl oz	4 fl oz	4 fl oz	2 fl oz	6.25 fl oz	6 fl oz
Active Ingredient	100% Block Polymer	100% Gluco Ether, Block Polymer Blend	100% Block Polymer	80% Non-ionic Surfactant	50% Humectants 0.4% Surfactants	100% Modified Block Polymer

Methods and Materials

Soil moisture and GPS data were collected on three greens at each golf course prior to and after wetting agent application during July and August in 2010 and June, July, and August in 2011. In total, 70 greens were tested. Approximately 100 soil moisture ratings were taken per green. Data was collected with a Spectrum Technologies FieldScout TDR 300 outfitted with three inch probes and a Garmin 72H GPS unit. Data was collected at a maximum of three days prior to and within five days after a wetting agent application. Data was processed using Dplot and Microsoft Excel.

What did the data look like?

Figure 1 demonstrates a Revolution® application. There was a distinct dry spot on the top left side of the green that was reduced after wetting agent application. The wet areas were not eliminated by the wetting agent application. Figure 2 demonstrates a Magnus™ application. The back half of this green was dry pre-wetting agent. After the wetting, the back half of the green had significantly more moisture.

Figure 1: *Soil moisture distribution prior to a Revolution® application and after a Revolution® application.*

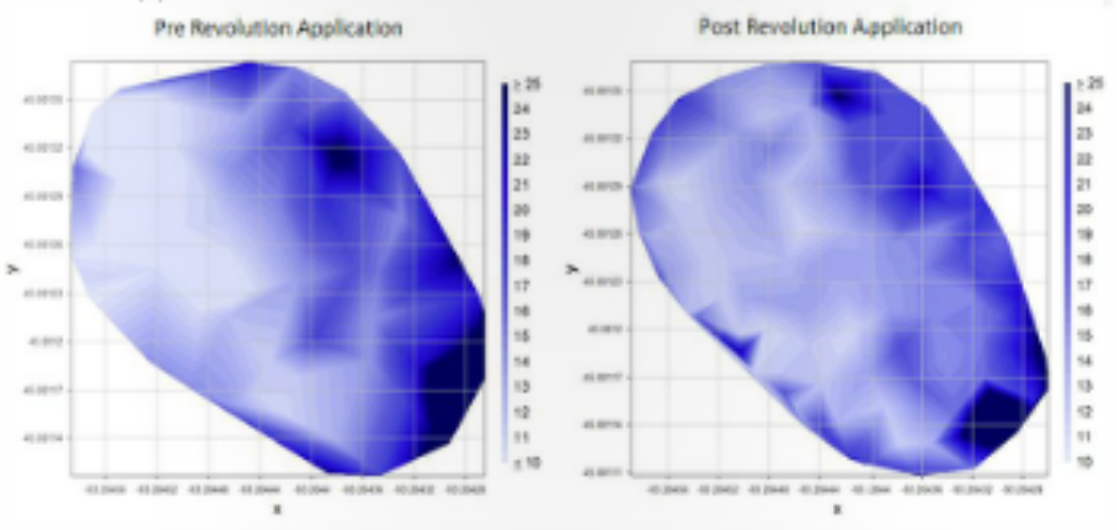
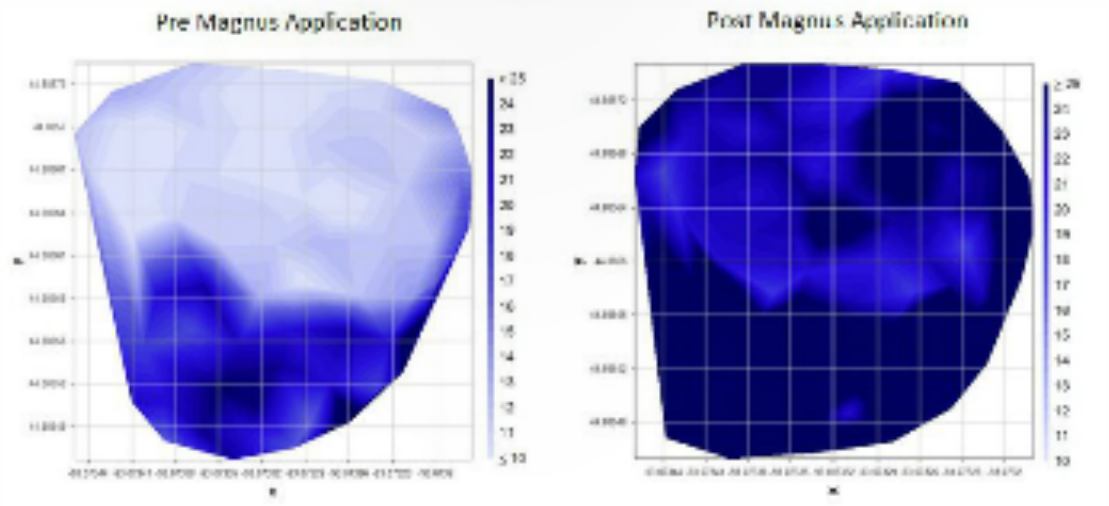


Figure 2: *Soil moisture distribution prior to a Magnus™ application and after a Magnus™ application.*



Results

The average soil moisture on a green before treatment ranged from 10.7% to 33.8% with an overall average of 20.2%. The average soil moisture on a green after treatment ranged from 11.4% to 35.9% with an overall average of 23.6%. Tricure™, Revolution®, Immerse GT, Magnus™ and Performa Gold showed increased soil moisture on most greens after the wetting agent was applied (Figure 3). The average increase in moisture for these products was 4.36%, with Magnus™ and Tricure™ exhibiting the greatest increases (Figure 5). Dispatch® decreased the soil moisture on all greens after it was applied. That decrease averaged 4.67%. APSA-80®, Tournament Ready®, and H3O™ each demonstrated an increase in some greens and a decrease in others.

The average soil moisture uniformity on a green before treatment ranged from 52.6% to 90.2% with an overall average of 76.1%. The average soil moisture uniformity on a green after treatment ranged from 57.0% to 90.0% with an overall average of 79.2%. Tricure™, Magnus™ and Revolution® exhibited increased soil moisture uniformity in 34 of 46 greens after the wetting agent was applied (Figure 4). The average increase in moisture uniformity for these products was 6.51% (Figure 5). Dispatch® and Tournament Ready® decreased the soil moisture uniformity on all greens after the wetting agent was applied. That decrease averaged 4.52%. APSA-80®, Immerse GT, Performa Gold, and H3O™ each caused an increase in some greens and a decrease in others.

Figure 3: *Count of the number of greens that increased or decreased soil moisture after a wetting agent application.*

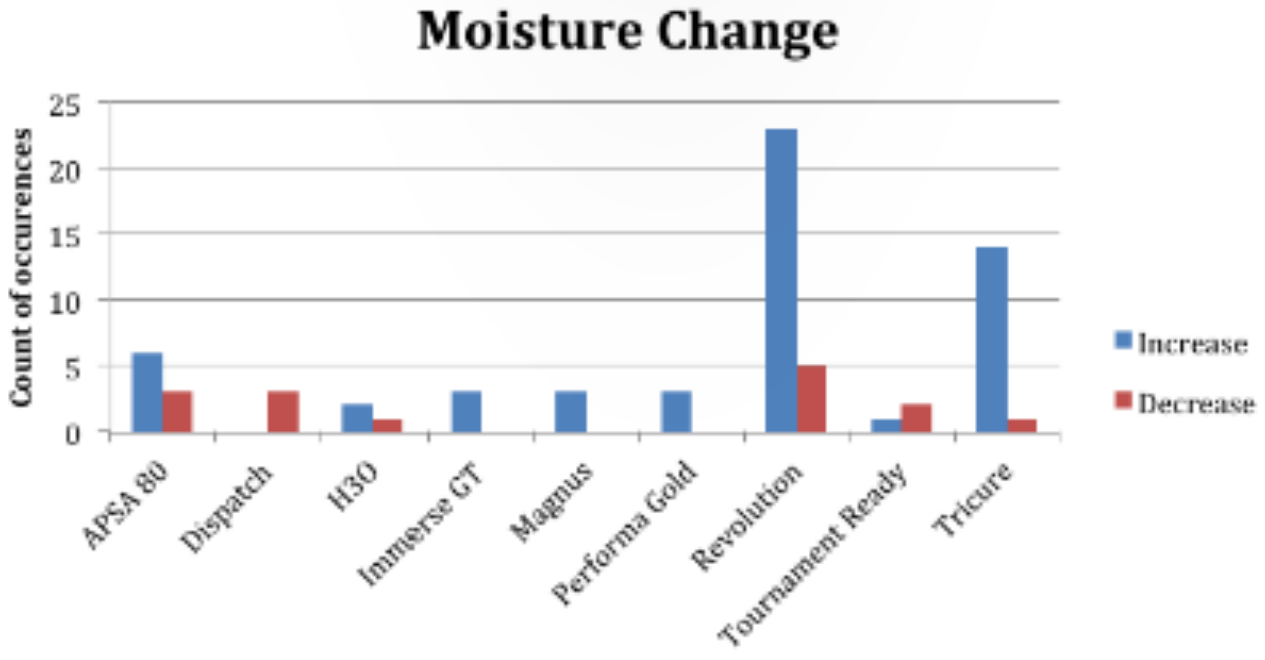


Figure 4: *Count of the number of greens that increased or decreased soil moisture uniformity after a wetting agent application.*

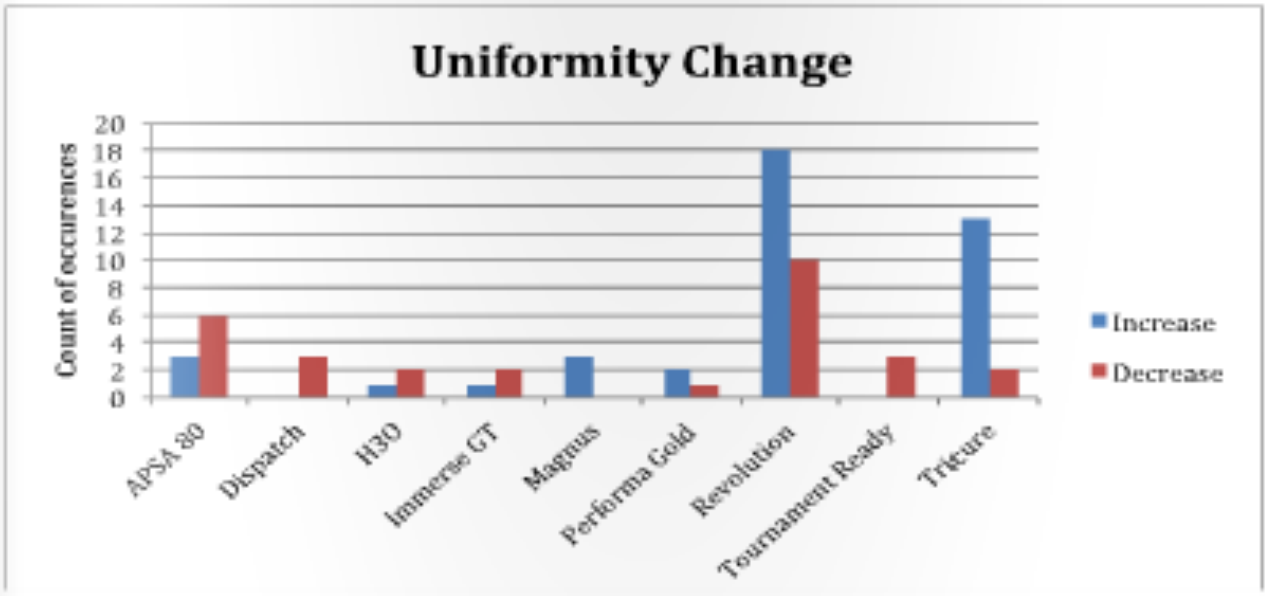
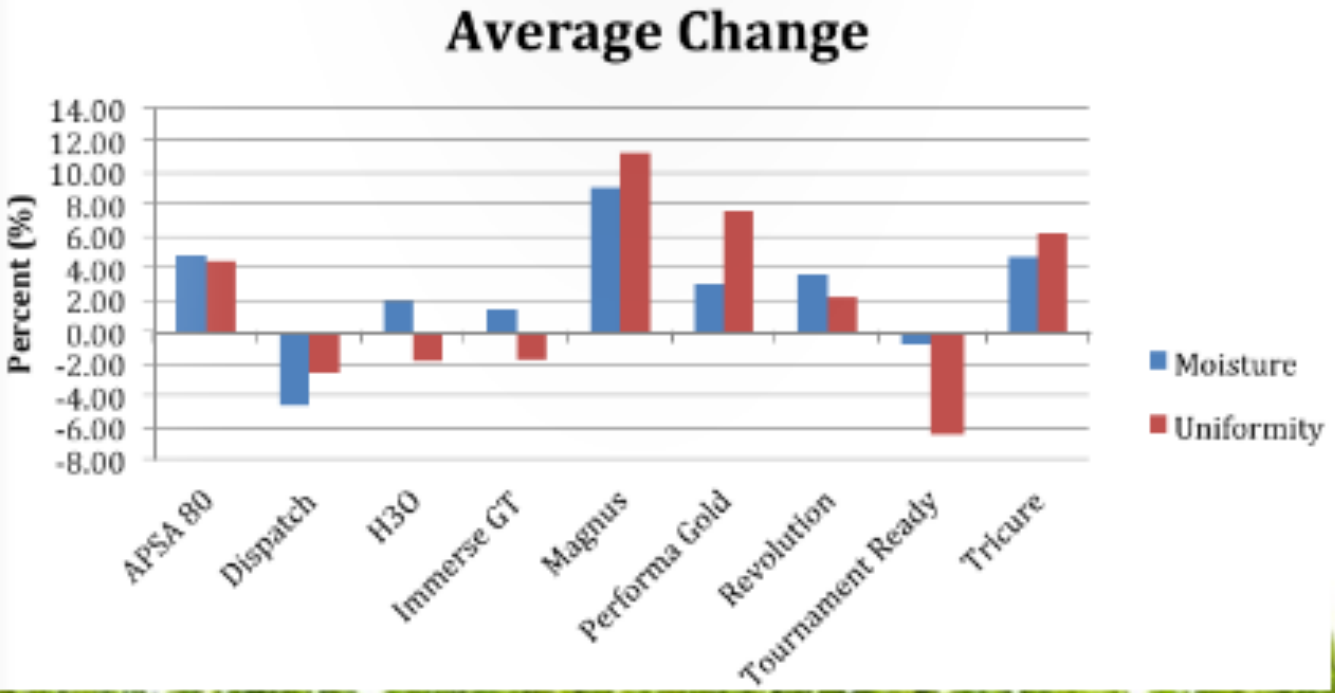


Figure 5: *The average percent change in soil moisture and soil moisture uniformity after a wetting agent application.*



Discussion

A few interesting comparisons can be looked at with this data, such as wetting agent interaction with precipitation, what happens when a course switches wetting agents, and most importantly what can we expect from a wetting agent. It could be suggested that the soil moisture and uniformity differences demonstrated are due to water input changes. Given the minimum span of two days between data collection, this is entirely possible. Total rainfall between ratings ranged from 0 to 4.33 inches, with an average of 0.73 inches. Irrigation systems ran one to four times between ratings, with an average of two runs. Across both years, when minimal water was added (only enough to water in the wetting agent) we saw soil moisture increase in 10 greens and decrease in 8 greens. Further, the same wetting agent caused both increases and decreases. When excess water was added between ratings, soil moisture increased in 45 greens and decreased in 7 greens. This shows that increased water inputs generally lead to increased soil moisture, but it is not the principal reason for the soil moisture and uniformity responses.

In 2011, three courses switched to a different wetting agent from the one they used in 2010. One course switched from Tournament Ready® to Revolution®. In 2010, Tournament Ready® decreased the soil moisture uniformity and had a marginal effect on the soil moisture levels. The Revolution® decreased the soil moisture and uniformity on 2 of 3 greens at the course in 2011. This course saw a similar response even though they switched wetting agents. Another course switched from Revolution® to Performa Gold. Both wetting agents caused a similar response in soil moisture uniformity, but the Performa Gold caused a slightly greater soil moisture increase. The final course switched from Immerse GT to Tricure™. During 2010, the Immerse GT had very little effect on the soil moisture and uniformity. In 2011, Tricure™ greatly increased moisture and uniformity in the greens.

General conclusions about the action of the wetting agents tested can be drawn from the data. APSA-80® is a non-ionic surfactant, which means it spreads water. APSA-80® does not contain agents that attach to soil like other wetting agents. This means an APSA-80® application is more responsive to precipitation levels. In 2010 the courses that applied APSA-80® saw less than 0.25 inches of precipitation between ratings and saw soil moisture loss and uniformity decreases. In 2011, these same courses had 0.75 inches of precipitation and the soil moisture and uniformity greatly

increased. Soldat (2010) studied APSA-80® and found that APSA-80® had no effect on water droplet penetration. Dispatch® caused decreased soil moisture and uniformity and therefore is a penetrant wetting agent. H3O™ is not truly a wetting agent. A component in H3O™ strongly attracts water, but does not attach to soils or spread water like traditional wetting agents. Therefore, it is expected that water will be attracted to where the chemical is in greatest concentrations. On greens that received H3O™ we saw a net increase in soil moisture, but a decrease in soil moisture uniformity, which suggests the water moved to where the chemical was located. Magnus™, Revolution®, and Tricure™ all caused increased moisture and uniformity. Therefore, those are all considered retaining wetting agents. Immerse GT, Performa Gold, and Tournament Ready® generally exhibited retaining capabilities, but did cause some decreases in soil moisture uniformity.

Conclusion

This study demonstrates a distinct soil moisture and soil moisture uniformity response to wetting agent applications. Wetting agents with similar active ingredients responded similarly across a golf course and between golf courses. It should be noted that data was collected in the top 3-in of the soil and these wetting agents may demonstrate different characteristics at shallower and deeper soil depths. Whether the goal of a wetting agent application is to reduce localized dry spots or move water through the soil profile, there appears to be a wetting agent that will work.

References

Karcher, D., M. Richardson, A. Patton, and J. Summerford. 2010. Wetting agent effects on rootzone moisture distribution under various irrigation regimes – year 2 summary. Arkansas Turfgrass Report 2009, Ark. Ag. Exp. Stn. Res. Ser. 579:50-56.

Karnok, K.J., K. Xia, and K.A. Tucker. 2004. Wetting agents: What are they, and how do they work? Golf Course Management Magazine. June: 84-86.

Kostka, S.J. 2005. ACA1820 – A novel chemistry for rootzone water management in turfgrass systems. Non-peer-reviewed Paper at the 10th International Turfgrass Society Research Conference.

Leinauer, B., P.E. Ricke, D. VanLeeuwen, R. Sallenave, J. Makk, and E. Johnson. 2001. Effects of soil surfactants on water retention in turfgrass rootzones. International Turfgrass Society Research Journal. 9:542-547.

Soldat, D. 2010. Comparison of three commercially available wetting agents. The Grass Roots. March/April: 30-32.