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Presidential Perspective

by Jake Schmitz, Superintendent at Olympic Hills Golf Club

"So when is it going to be my turn?" Having four kids aged 10 and younger, I have to admit that

this is not one of my favorite phrases. Typically, that phrase involves loud voices, minor wrestling, attempted negotiations, and usually ends up with some tears running down long faces. This is about the time when I lock myself in the garage and let my wife deal with it! The garage time also includes some self-reflection, as I try to ascertain how it is possible that we don't have the whole sharing concept down to an art after four kids. Fact of the matter is, my wife and I continually work at improving our methods for raising the kids, and she is exceptional at it (I, on the other hand, am still a work in progress.) Emotional meltdowns and wrestling matches are handled with distractions and laughs versus raised voices and anger. We've been able to successfully adapt our methods over time to manage the chaos, and our household is a lot of fun, believe it or not.

I have included a brief narrative about my family, not because you are at all interested in my personal challenges, but rather because there is an important correlation that can be made to our livelihoods in golf course management. Over the course of the last three years, a significant amount of press has been devoted to droughts in California and Texas, as well as the aquifers that flow down from the Rockies to Arizona. Recently, golf courses in California have been mandated to reduce irrigation by 25% due to extreme drought. Back in 2005, Georgia golf courses made national news for their efforts in the development of BMP's for water conservation.

Even in the upper Midwest, portions of the Great Lakes Region are dealing with drought-related issues where water use is being questioned. So when is it going to be Minnesota's turn? Realistically, our turn has already arrived. The formation of a legislative commission to oversee water use and permits has been formed. The Minnesota DNR has plans for drilling 70 monitoring wells, and staff has been

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brought on to review appropriations on a course by course basis. Studies being performed by state agencies are slowly revealing that water in The Land of 10,000 Lakes is not an infinite resource.

So what should be the response to possible water restrictions? Do we fight to keep what is 'ours'? Do we bring together allied associations to stand up to the legislature and state agencies, shaking our fists and demand that what was appropriated in the 80's continue through perpetuity? Do we give homeowners the bird when they complain about not being able to water their lawns, yet the neighboring golf course is irrigating on a daily basis? Our claim has been that we need to fight for our water rights because golf is a business, and the only way our business will survive is if we continue to maintain our courses the same way we have done it in the past. Does an argument such as this carry any weight in California right now?

Golf course managers are adept at figuring out solutions to problems. We are known for tweaking certain aspects of our operations in order to make things better. Whether it is agronomics, budgets or HR management, creative outcomes

are abundant in the world of a superintendent. However, the issue with water is somewhat of a different animal. Our clientele has become accustomed to green, manicured properties. Golfers drool over the perfection of Augusta during Masters Week, and that perception of golf course conditioning is embedded in their expectations to a certain degree. Likewise, superintendents have had the tools, knowledge and resources to manage for green grass. I am as guilty as anyone in promoting the green, lush conditions throughout the property at a private golf club facility. Can this style of management continue, and are we prepared for the day when a 25% mandate is handed down to golf courses in Minnesota?

As golf courses continue to struggle with increasing costs and static or declining revenues, maybe the whole water issue itself presents an opportunity for golf in Minnesota. What if financial opportunities were available for clubs to convert their roughs and fairways to drought tolerant grasses? Would our customers still play the game if both of these areas were a palate of colors, including brown, gold and green? Could it be that the prospect of reduced irrigation might actually have a positive effect on the financial health of our facilities? With the right grasses in place, reduced water in conjunction with less mowing, limited fertilizers and reduced pesticide applications seems like it might be a ticket for healing some of the problems in the golf business. But will our customers accept alternative conditions, or simply abandon the game because it isn't wall-to-wall green?

Under-the-gun change is extremely difficult to navigate. While the threat of tightened restrictions on water use is imminent. there is still time to begin the implementation of conservation practices. Implementation begins with communication, and that is where our allied associations can help create awareness of the issue. Helping our customers understand that the current golf course maintenance model is not at all business savvy is paramount. As awareness increases amongst the golf community, superintendents will have the opportunity to begin picking away at areas on the course where irrigation is not needed, with the possibility of implementing widespread conservation practices by eliminating water on roughs and (dare I say it?) fairways.

Awareness and education are the stepping stones to making changes; it will be up to golf course managers to be creative and figure out how to maintain their properties under a different model.

I believe that big changes are in store for golf. Being forced into something is much more difficult when one is not prepared, and we all know that water restrictions will be implemented in the state of Minnesota at some point. These reductions in water usage will not be temporary, because conservation begins before the situation becomes dire. Minnesota golf has an opportunity to be the leader and show courses throughout the nation that there is a different way to maintain turf – and it just might be that our courses become that much better through solid environmental practices that are implemented wholeheartedly. Again, do we fight to protect 'our' water rights, or lead the charge on self-imposed conservation measures to protect the resource? I would bet that there are some courses in California that regret not making a change when the writing was on the wall.

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In Bounds by Jack MacKenzie, CGCS

The other day I was in my local big box store returning

a vanity my wife had selected for installation in the guest bathroom, a winter upgrade project still on the to-do list. Although a picture of the model was on my smart phone, I hadn't heard correctly that it was to be white and not brown (another story I may share some day). Familiar with the return process, I pulled near the entry doors and proceeded to the guest desk.

"Hello and welcome to our store", she greeted me, obviously a catchy phrase heard at the local Walmart by a professional greeter whose only job is to say "hello".

"Hi Amber (not her real name), would you like me to bring the vanity in here or complete the paperwork and drop it off and exchange for a new one in the pick up area?" I asked the youthful gal. With a curious look, she directed me drive around back and tell the gate guard I needed to give the vanity in the plumbing department. She had no interest in my receipt, nor desired to provide me a return order slip.

Thus began an additional 45 minute-run around with me being passed through the gate by the gate guard without proper paperwork, exchanging the vanity in the plumbing department for the correct one (however now I needed the proper paperwork to leave), going back to the desk to question the gal as to her original directions, being told to return to the gatehouse with the original vanity, pick up the exchange paperwork from the gate guard to be filed with the plumbing department after I traded the brown vanity for the same model in white. I also had to bring the paperwork from the gate guard to the front desk for an exchange voucher to get back out of the gate.

At the end of the experience, I was pissed. And, after cooling down a bit, rather embarrassed, as I had allowed my frustration to squeak out and I made a couple of strong suggestions to the gal on how to improve the service she provided. My bad for acting out...or was it?

How often had I heard that the quality of a solid individual isn't the way they act during normal operating procedures, but rather how they *react* when presented with a challenge? My reaction to this situation, one I thought I had preempted through consulting Amber prior to returning the vanity, had escalated to a place where I had compromised my integrity.

So what broke down in my quest for a simple exchange? To answer my question I thought long and hard and even consulted "the Google" for direction. Yes, I was clear in my request, had my receipt in hand and presented myself in an adult fashion. Yes, the gal heard what I had said, what my desire was and eventually my parting comments. Then it occurred to me to turn the question around. Perhaps it wasn't so much me but rather a lack of competency in the young individual I was interacting with.

Surely this isn't a reflection of all youth today as I had a great experience with the kid in plumbing. He understood each of the challenges I had experienced and even went back to the front desk on my third trip to help the gal come to a final solution. Not that there was any difference in his discourse...maybe it was "the third time is the charm" syndrome. That got me wondering what Amber was doing in the position she was placed?

This wasn't an "individual" issue but more likely a management snafu. Amber was in over her head at the service desk and may likely be in the deep end of the pool for the rest of her life. Having been a fairly successful manager for over three decades I instinctively knew who was "club house grounds material" and who would be better doing service chores ahead of and beyond interaction with play. This gal would have been a wonderful divot dresser between the hours of 5 and 7 am. Why didn't a manager recognize this individual's abilities and offer quality training, or maybe just some training?

In hindsight, I didn't need to become upset with the situation and should have known better than become irritated with the employee. It was, and likely still is, a management problem and something well beyond my control. Is there anyone on your crew that could use a little extra training? Maybe you need to create a position where they can be productive without compromising the service offered your clientele.

Or maybe I need to be more observant and a bit more tolerant. I'll have to think about that.

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FORMAT: FOUR-PERSON SCRAMBLE

11:30 - 12:45 p.m.	Registration – Driving Range available, lunch
1:00 p.m.	GOLF - Shotgun
5:30-7:00 p.m.	Reception and heavy appetizers
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------ REGISTRATION FORM ------

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LEGACY SCHOLARSHIP ANNOUNCEMENT

The Program: The Minnesota Golf Course Superintendents' Association offers a scholarship program designed to assist children and grandchildren of Class AA, A, SM, C, D, Associate and Affiliate members. The MGCSA provides scholarships to students attending college or vocational programs at any accredited post-secondary institution. The program is independently managed by Scholarship America, a national non-profit student aid service organization. Awards will be granted without regard to race, color, creed, religion, sex, disability, national origin or financial need.

Selection of Recipients: Scholarship recipients are selected on the basis of academic record, potential to succeed, leadership and participation in school and community activities, honors, work experience, a statement of education and career goals and an outside appraisal. Selection of recipients is made by Scholarship Management Services. In no instance does any member of the MGCSA play a part in the selection. Applicants will be notified by the end of July whether they have been awarded or denied a scholarship.

Eligibility: Applicants for the MGCSA Legacy Scholarships must be: children/ grandchildren of Class AA, A, SM, C, D, Associate or Affiliate members who have been members of the MGCSA at least five years; High school seniors or graduates who plan to enroll or students who are already enrolled in a full-time undergraduate course of study at an accredited two- or four-year college, university or vocationaltechnical school, and under 23 years of age.

Awards: Three awards will be given to children and grandchildren of Class AA, A, SM and C members. One award of \$1,500 in the name of Joseph S. Garske will be given to the highest evaluated applicant. That award will be renewable for one year contingent upon full- time enrollment and satisfactory academic performance. One other \$1,000 award will be given to other qualified applicants from this group. One \$1,000 award will be available to children and grandchildren of Class D, Associate and Affiliate members. These awards are not renewable. However, students may reapply to the program each year they meet eligibility requirements. Awards are for undergraduate study only.

Obligations: Recipients have no obligation to the MGCSA or its members. They are, however, required to supply Scholarship Management Services with current transcripts and to notify Scholarship Management Services of any changes of address, school enrollment or other relevant information. Except as described in this brochure, no obligation is assumed by the MGCSA.



Application Deadline: June 1, 2015. More info at: www.mgcsa.org











2015 TURFGRASS FORUM

A Free Informational Discussion & Round Table for MGA Member Clubs and Members

- Speakers:
 - **Dr. Brian Horgan**, University of Minnesota Turf Extension Specialist
 - Mr. Robert Vavrek, USGA Senior Agronomist, Central Region
 - Mr. Tyler Riggin
 USGA Regional Affairs Director Great Lakes
- Topics will include:
 - THE LATEST ISSUES FACING GOLF COURSE TURFGRASS WINTER WEATHER IMPACTS USGA - STATE OF THE GAME
- Thursday, April 30 at Midland Hills Country Club 8:00 a.m.....Registration (coffee & rolls) 8:30 a.m.–12:00 p.m.Presentations & Discussion

This meeting is for: Course Owners, General Managers, Golf Professionals, Golf Course Superintendents, Club Presidents, Greens Chairs and any other MGA Members.

- <u>There will be no fee for this forum.</u>
- GCSAA educational points available.
- PGA MSR credits available.
- For Reservations: Joel Comstock, Regional Affairs Director of the MGA 952-345-3968 or joel@mngolf.org Please provide your name and golf course affiliation.

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Make Your Team: Brackett's Crossing Country Club, October 12, 2015

Member Driven Research Growing Degree Day Modeling for Trimmit and Cutless Applications on Creeping Bentgrass Fairways

Dr. Brian Horgan, Sam Bauer, Matt Cavanaugh

The goal of this Member Driven Research project was to find a Growing Degree Day (GDD) model for Trimmit 2SC (paclobutrazol) and Cutless 50W (flurprimidol) on creeping bentgrass fairways. Trimmit and Cutless are both great tools for managing clippings in creeping bentgrass

fairways and for annual bluegrass reduction programs. However, historically application intervals have been based on a calendar schedule and not on the rate of product metabolism in the plant. Research has shown that plants metabolize these plant growth regulators more quickly as temperatures begin to rise (Branham and Beasley, 2007).

By using a growing degree day model, superintendents are better able to manage the rebound



Growth regulator trial at Medina Golf and Country Club. Picture taken on September 5, 2014.

effect that is often associated with the use of plant growth regulators, and to also avoid applying too frequently. The hope with this model is to then help prevent the rebound effect and allow users to maintain a consistently suppressed growth rate throughout the growing season.

Materials and Methods

This study was conducted at Medina Golf and Country Club on a

Treatment	Rate (oz/A)	App interval, GDD (Celsius)	Number of Applications	Pounds of a.i./A used during the season
Control		(0010103)		0
Cutless 50 W	10	200	12	3.75
Cutless 50 W	20	200	12	7.5
Trimmit 2 SC	10	200	12	1.2
Trimmit 2 SC	20	200	12	3.84
Cutless 50 W	10	350	7	2.1875
Cutless 50 W	20	350	7	4.375
Trimmit 2 SC	10	350	7	1.12
Trimmit 2 SC	20	350	7	2.24
Cutless 50 W	10	500	5	1.5625
Cutless 50 W	20	500	5	3.125
Trimmit 2 SC	10	500	5	0.80
Trimmit 2 SC	20	500	5	1.60

Table 1: Treatment rates, application interval, number of applications and amount of active ingredient used during the season for the Trimmit and Cutless growing degree day study. Rate for Trimmit is fluid ounces and the rate for Cutless is dry ounces.

'Memorial' creeping bentgrass fairway established in 2012. The treatment areas were mowed at 0.500 inches 3-4 times per week. Treatments consisted of Trimmit 2SC (paclobutrazol) and Cutless 50W (flurprimidol) applied at 10 and 20 oz/A and also at 200, 350 and 500 Growing Degree Day (GDD) intervals in Celsius (Table 1). Please note the rate for Trimmit is fluid ounces and the rate for Cutless is dry ounces. Growing degree days were calculated using a base 0 degrees Celsius and then simply adding the daily mean temperature in Celsius. A calculator developed by the University of Wisconsin-Madison was used to quickly and accurately track and record our GDD (http://turf.wisc.edu/growing-degree-day-maps/primo-trimmit-re-application-intervals/).

Treatments were then initiated when the appropriate GDD was met and the calculation was reset on the day of the new treatment application. Spray volume was set at 2 Gal/M and all treatments were watered in with 0.25 inches of water within 24 hours of application, but before the next mowing. Data collection consisted of clipping weight collection by making a single pass down the middle of the plot area with a Toro Greensmaster 1600 (The Toro Company, Bloomington, MN). Post-harvest, clippings were dried in an oven set to 95°F for at least 48 hours before being weighed. Chlorophyll index was determined using the Filed Scout CM1000 (Spectrum Technologies, Aurora, IL). Turf quality was visually assessed on a 1-9 scale with 6 being minimally acceptable turf. Data was collected 1x/week starting on May 22nd, 2014 and ending on September 25th, 2014.

Results

Results from this trial are fairly clear and offer some valuable information if you plan to use either Trimmit or Cutless on bentgrass fairways. The three GDD intervals of 200, 350 and 500 provided an average application interval of 10, 17 and 24 days, respectively. This resulted in 12, 7 and 5 applications at 200, 350 and 500 GDD, respectively, from May 15th to August 24th, 2014.

In a fairway situation, many superintendents use plant growth regulators to reduce the amount of clippings that need to be managed. For those





Figure 1: Average treatment growth from May 22 to September 25th, 2014 in relation to the control. Lower numbers represent less growth. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.05$) among treatments.

that collect clippings, this reduces time and labor required to dump and dispose clippings, but it also reduces the amount of time spent using a turbine blower to disperse clippings for those not collecting clippings. It can often be a battle and plant growth regulators, when used right, can help ease the pain. When looking at average growth from May 22nd to September 25th, 2014, all treatments stayed below the amount of growth that the control provided ranging from 80% of the control for Trimmit and Cutless at the 10 oz/A rate on a 500 GDD schedule to around 30% of the control for Trimmit and Cutless at the 20 oz/A rate on a 200 GDD schedule (Figure 1). However, looking at the average growth for each treatment over a large part of the growing season does not tell the whole story as some rates and GDD intervals did come out of regulation (rebounded)

or came very close at certain times of the year. **500 Growing Degree Day Interval**

Trimmit at the 10 oz/A rate on a 500 GDD schedule rebounded to growth above the control on three collection dates, June 12th, July 3rd and September 11th which was 508, 448 and 499 GDD's after each application, respectively (Figure 2). This same treatment was also very close to rebounding on July 24th (89% of the control) which was at 440 GDD's and most likely had rebounded by the next application date of July 28th which was at 509 GDD's. Similar results were seen with Cutless at the 10 oz/A rate on the 500 GDD schedule which had growth near the control on June 12th, July 3rd, and July 24th which was 508, 448 and 440 GDD (Figure 2). Based on these numbers we do not recommend using either product at the 10 oz/A rate on a 500 GDD schedule if you do not want to have a rebound of growth at or above untreated turf. Looking at the same 500 GDD



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Figure 2: The percent growth versus the control for Trimmit and Cutless at the 10 and 20 oz/A rate at the 500 growing degree day interval. Applications intervals averaged 24 days between applications from the initial application on May 15 to the final application on August 19th, 2014. Red arrows indicate when additional applications were made following the initial application on May 15th.

schedule, both Trimmit and Cutless at the 20 oz/A rate provided a different story. At this higher rate we did not see growth rebound nearly as much as with the 10 oz/A rate (Figure 2). The highest growth was seen at 78 and 87% of the control for Trimmit and Cutless, respectively, during the growing season with much of the growth being below this (Figure 1, Figure 2). This shows that both products at the 20 oz/A rate and the 500 GDD interval would provide growth below the control throughout the application period, but may not provide much of a buffer if applications cannot be made immediately at the 500 GDD mark. All treatments did rebound significantly (160% of the control or more) by September 18th which was 592 GDD's after the last application on August 19th (Figure 2).

350 Growing Degree Day Interval

With the 350 GDD interval we did not see any rebound at or above the control with either the 10 or 20 oz/A rate (Figure 3). The highest growth percentage versus the control was around 85% on July 24th (347) GDD) for the 10 oz/A rate of both Trimmit and Cutless (Figure 3). The average growth versus the control throughout the growing season for both products at the 10 oz/A rate was near 60% (Figure 1, Figure 3). At the 20 oz/A rate there was never any jeopardy of rebounding with the highest growth percentage versus the control on July 10th for Cutless (54%) and on July 24th for Trimmit (63%) with the average growth versus the control throughout the growing season at under 40% (Figure 1, Figure 3). If you are wanting a manageable growth rate that does not rebound we would recommend using the 10 oz/A rate with either product versus the 20 oz/A rate. The 20 oz/A rate may be an option for poa annua control, but seems to provide a little too much suppression for general bentgrass maintenance. This is even reflected in the chlorophyll index with Trimmit and Cutless at the 10 oz/A rate providing the best color and Trimmit at the 10 oz/A rate being statistically different from seven treatments including the control (Figure 4). All treatments did rebound above the control by September 18th which was 475 GDD's after the last application on August 24th (Figure 3).

200 Growing Degree Day Interval

With the 200 GDD interval we saw a significant growth reduction (Figure 1, Figure 5). By the second application, growth versus the control was almost always under 40% for the 10 oz/A rate and almost always under 20% for the 20 oz/A rate for both products (Figure 5). This is a significant growth reduction especially at the 20 oz/A and although the chlorophyll index readings would indicate that the 20 oz/A rate was not statistically different to most of the treatments, they were certainly different to the eye (Figure 4, Picture 1, 2 & 3). These plot areas were more of a dark purple with a little bit of silver (silvery purple if that can happen) Page 26



Figure 3: The percent growth versus the control for Trimmit and Cutless at the 10 and 20 oz/A rate at the 350 growing degree day interval. Applications intervals averaged 17 days between applications from the initial application on May 15 to the final application on August 24th, 2014. Red arrows indicate when additional applications were made following the initial application on May 15th.

and had a more coarse leaf blade, but never turned brown or died. There was so little growth coming from these plots that recuperative ability of the plant was greatly diminished based on season long observations of play still happening on the plot area. Based on the look of these plot areas and the excessive growth reduction, we are not recommending the use of either product at the 10 or 20 oz/A rate at the 200 GDD interval. All treatments did rebound above the control by September 25th, with the exception of Trimmit at the 20 oz/A rate , which was 601 GDD's after the last application on August 24th (Figure 5).



Above, pictures 2 and 3. Left, Trimmit applied at 20 az/A every 200 GDD. Right, Cutless applied at 20 oz/A every 200 GDD. Pictures taken on July 31, 2014.

Discussion

This member driven research project has identified two rates and two application intervals that can be used to provide a more consistent growth rate of creeping bentgrass fairways. The two models recommended are 500 GDD at 20 oz/A and 350 GDD at 10 oz/A. This does then indicate that rate does matter and can increase the longevity of control. However, it is believed that using the 500 GDD interval at the 20 oz/A rate will provide less of a buffer if applications are not able to hit the 500 GDD interval. Using the 350 GDD intervals will be the safer option. However, keep in mind the use rate restrictions of both products. Based on the label, you are limited to 2 lbs. a.i./A/year for Trimmit and 3 lbs. a.i./A/year for Cutless. Based on the number of applications we had, the recommended rate of Cutless at 500 GDD at the 20 oz/A rate did exceed the label use rate restrictions, but Cutless at the 350 GDD interval at the 10 oz/A rate did not



Figure 4: Chlorophyll index readings for Trimmit and Cutless applied at 10 and 20 oz/A on 200, 350 and 500 growing degree day intervals. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.05$) among treatments.

(Table 1). This would mean needing to start a little later or end earlier to accommodate the 500 GDD interval at the 20 oz/A rate with Cutless or using a slightly lower rate than 20 oz/A. Use rates for Trimmit at 350 GDD at the 10 oz/A rate and 500 GDD at the 20 oz/A rate did not exceed the label restrictions.

Research has shown that plants metabolize plant growth regulators more quickly when temperatures begin to rise. This would indicate that using a calendar based system to apply plant growth regulators would not be very accurate. In this study 200 GDD was achieved between 8 and 13 days, 350 GDD was achieved between 15 and 20 days and 500 GDD was



Figure 5: The percent growth versus the control for Trimmit and Cutless at the 10 and 20 oz/A rate at the 200 growing degree day interval. Applications intervals averaged 10 days between applications from the initial application on May 15 to the final application on August 24th, 2014. Red arrows indicate when additional applications were made following the initial application on May 15th.

achieved between 22 and 28 days depending on the time of the year. Using a GDD schedule outlined in this study will allow you to better achieve consistency with your bentgrass fairway regulation program.

Literature Cited Branham, B., Beasley, J. Golf Course Management July. 75(7): p.95-99

MGCSA Member Driven Research

Member Driven Research to be Presented!!















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- 10:45 11:45 Emerald Ash Borer Update, Jeff Palmer Arborjet
- 11:45 12:30 Incredible Lunch
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Member Driven Research Growing Degree Day Modeling for Primo Applications on Creeping Bentgrass Putting Greens

Dr. Brian Horgan, Sam Bauer, Matt Cavanaugh

Plant growth regulator use on golf courses has increased dramatically over the past two decades. During this time, researchers and superintendents have constantly been looking for ways to improve the application strategies for these products. Trinexapacethyl (TE), trade name Primo Maxx,

is a commonly applied gibberellic acid synthesis inhibitor which is used for growth suppression, turfgrass quality, and density improvement.

Research has demonstrated that the metabolism of TE occurs at a



Extension Turfgrass Science

on greens being used by many golf course superintendents relies on applications every 200 GDD (base 0° C) which was developed by researchers at the University of Wisconsin-Madison. These researchers did not find a difference in the magnitude or duration of suppression by increasing the

> application rate from 0.125 oz to 0.25 oz of Primo Maxx per 1000ftsq (Kreuser and Soldat, 2011); this suggests that application rates may be too high. For more background on the utilization of GDD for plant growth regulator applications, see the comprehen-

faster rate when temperatures increase in the summer months (Branham and Beasley, 2007). For this reason, growing-degree-day (GDD) models have been used to schedule TE applications in an effort to maintain consistent suppression of putting greens. The current model for TE applications sive review by Dr. Bill Kreuser from the University of Nebraska-Lincoln in the April 3rd, 2015 issue of USGA Green Section Record (Kreuser, 2015).

This Member-Driven Research study attempts to validate the 200 GDD model for the 0.125 oz per 1000ftsq application and investigate the differences in rate affect by applying rates below 0.125 oz per 1000ftsq.

Materials and Methods

In year one, treatments were initiated on May 24th of 2013 on a

USGA specified 'L-93' creeping bentgrass green at the Turfgrass Research, Outreach, and Education Center in St. Paul, MN. In year two, treatments were initiated on June 4th, 2014. Treatments were applied in a water volume of 1gal per 1000ftsq at rates of 0.03125, 0.0625, 0.09375, and 0.125 oz per 1000ftsq Primo Maxx (Syngenta) applied at four week intervals for a total of five applications each year.

Maxx was applied on a 200 GDD application schedule, which resulted in 12 and 13 total applications for 2013 and 2014, respectively. In both years, treatments were applied until late September. Clippings were collected from individual plots three times per week

with a Toro 800 walking greensmower. Mowing height was set at 0.125 inches and the entire study area was mowed six times per week.

Following clipping collection, clippings were dried at 95° F for 48 hours, cleaned of sand and weighed. Data collection also included turfgrass quality

Turf scientest Matt Cavanaugh applies Primo

Within this four week period we looked to see when suppression begins, peaks, and ends. Additionally, a 0.125 oz per 1000ftsq rate of Primo and chlorophyll index measurements. Plots received a general maintenance application of ammonium sulfate applied at 0.10 lb nitrogen per 1000ftsq



Figure 1: Clipping dry weight of 0.125 oz/1000ftsq Primo Maxx versus the clipping dry weight of the untreated control throughout the 2014 growing season. Values reported are grams/12.5ftsq.

weekly.

Results

We have split the results into three separate sections. First, we look at the 200 GDD model with Primo Maxx applied at 0.125 oz per 1000ftsq over the course of a growing season. Second, we discuss the effects of reducing Primo Maxx rates below 0.125 oz, including the magnitude and duration of suppression. Finally, we investigate the turfgrass quality benefits from Primo Maxx applications.

200 GDD model

Seasonal growth fluctuations are to be expected with any plant positioned in a natural environment. This is no different for creeping bentgrass putting greens. Over the course of a growing season we observed significant growth fluctuations from both TE treated and untreated plots, depending on the various environmental and management factors (ex: temperature, moisture, day length, nutrition) that were influencing turf growth at the various times. Not surprisingly, treated and untreated plots demonstrated similar, or almost identical, Page 34 growth patterns at each individual rating date throughout the 2013 and 2014 season (Figure 1). Generally, growth was greatest during the late-summer and early-fall.

Spraying TE on the 200 GDD schedule required a total of at least twelve yearly applications. These applications began in late-May or early-June and ended in late-September. The longest interval between applications was four-teen days, and the shortest was seven days. On average the 200 GDD model required applications every 9.5 days.

While seasonal growth tends to fluctuate, we were able to maintain consistent suppression with TE treatments throughout the season, without rebounding (Figure 1). On average, TE treated plots were suppressed by 20%; in other words, they grew at an 80% rate of the control, depending on which way you like to look at it. By mid-September and into early October, the clipping yields for both treated and untreated plots were almost the same. An explanation for this would be that TE treated plants redirect carbohydrates from shoot growth to tiller growth, and by the end of the growing season tiller numbers would be greater on the TE treated plots, translating to more shoots and therefore more yield. Operating under this assumption, total shoot length is still being suppressed with the applications.

These results validate the 200 GDD model as being effective for maintaining consistently suppressed creeping bentgrass putting greens in Minnesota. After two years of investigating this, we feel confident that you will not come out of regulation by using this approach. The next questions we need to ask are, is the 200 GDD model overly conservative and what effect does the application rate have on the level and duration of suppression?

Rate effects

To investigate the effects of TE application rate on the magnitude and duration of creeping bentgrass suppression, we evaluated rates at and below the current recommendation of 0.125 oz per 1000ftsq. The lower rates we used (0.03125, 0.0625, 0.09375) are equivalent to approximately 25, 50, and 75% of the recommended rate. By applying these rates at four week intervals, we were able to determine when the creeping bentgrass initially goes into suppression, the peak point of suppression and how long it took to get there, and when growth resumes to at or above the control.

Results can vary greatly over the course of a growing season and for this reason we chose to conduct this study over multiple years with four replications and three data collections per week. We cannot attempt to include all of this data within this article, so we have chosen to summarize our results across the two years and include figures that tell the basic story of what we are seeing from this research.

Results from both years of this study demonstrate approximately 20 percent suppression from the 0.125 oz rate of Primo Maxx. By reducing this rate, a corresponding drop in the level of suppression was observed; lowest rates provided the least amount of suppression, in general. However, the duration of suppression was similar across all rates applied. We observed the initial start of suppression at approximately 30 to 60 GDD. Peak suppression, the point when suppression of creeping bentgrass was the greatest, was observed between 235 and 280 GDD. Finally, release from TE applications, when the



Figure 2: Percent clipping yield versus the control (representing 100% growth) from July 19th to August 14th, 2013.



Figure 3: Percent plant growth versus the control (representing 100% growth) from July 30th to August 25th, 2014.

plant was at or above the control, occurred between 380 and 425 GDD. This

release was followed by a rebound phase in which the TE treated plots grew at a faster rate than the untreated control. This is one of the main reasons why it is desirable to schedule TE applications using the GDD model.

Figures 2 and 3 represent individual four week time periods from 2013 and 2014, with each of the four application rates and their respective clipping growth relative to the untreated control. In Figure 2 (2013), you can see that the peak point of suppression for all treatments is approximately 280 GDD.

While individual clipping yields fluctuate, generally all TE treated plots were suppressed by ten to 30% compared to the control until the point of release. The effects of TE application rate are very apparent in Figure 3 (2014), with lower rates corresponding to less clipping suppression. Note that in both figures the start of and release from suppression is occurring at similar times no



Figure 4: Chloropyll index comparing the 0.125 oz/1000ft2 every 200 GDD rate versus the untreated control during the 2014 growing season.

matter what the rate.

Turfgrass quality

Turfgrass quality (TQ) and chlorophyll index (CI) measurements were recorded weekly for all treatments. Generally, TE treated plots received higher ratings for both TQ and CI. The four week TE applications were allowed to come out of regulation and therefore did not provide a clear picture of the improvements in TQ and CI with the TE applications. The 200 GDD TE applications at 0.125oz per 1000ftsq consistently provided greater TQ and CI values in both years of this trial and this is consistent with other studies that demonstrate the improved quality and color benefits from TE applications. Figure 4 shows CI values for the 200 GDD TE treated plots compared to the untreated control throughout the growing season of 2014. As you can see, TE treatments received consistently greater CI values for a majority of the growing season, with the greatest difference being observed in the fall.

Discussion

This research validates the 200 GDD model as a good strategy to consistently maintain suppression of creeping bentgrass putting greens throughout the growing season. Keep in mind that while suppression may be consistent, that doesn't always translate to consistency of growth over the course of a season; growth will always be a reflection of weather conditions and management practices. Initially we proposed the idea of using higher rates in the summer months when metabolism of TE occurs more rapidly, however it appears that increasing the rate will have little effect on the duration of suppression. Higher rates of TE produced a greater level of suppression, but all rates (at or below label recommendations) released from suppression as a certain level of GDD are accumulated; in this study that occurred at approximately 380 to 425 GDD. Based on this, the current 200 GDD model appears to be conservative or "safe", meaning that release from TE will not occur within 200 GDD. However, if the goal of your regulation program is to consistently maintain 20% suppression, then the 200 GDD model is the best model to use. Adjusting the model to 225 or 250 GDD will still maintain 10% suppression or more, without rebounding, and this could be the difference between twelve season-long applications versus nine or ten, which can be fairly impactful on your labor and budget. In an average year, the 250 GDD program would require an application every twelve days on average, compared to every 9.5 days with the 200 GDD program. For superintendents looking to achieve lower levels of creeping bentgrass suppression, a rate reduction will accomplish this, but we would still suggest using the 200 to 250 GDD model.

Acknowledgements

We would like to sincerely thank the members of the Minnesota Golf Course Superintendent's Association for funding and directing this Member-Driven Research project. Your vision and initiative made this research possible.

Literature Cited

Branham, B., J. Beasley. 2007. Golf Course Management. July. 75(7): p. 95-99.

Kreuser, William C., Soldat, Douglas J. 2011. A growing degree day model to schedule trinexapac-ethyl applications on Agrostis stolonifera golf putting greens. Crop Science. September. 51(5): p. 2228-2236.

Kreuser, B. 2015. USGA Green Section Record. April 3. 53(7): p. 1-10.



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Member Driven Research



Wetting Agents and Their Effect on Surface Firmness and Winter Health of Bentgrass Putting Greens

Dr. Brian Horgan, Sam Bauer, Matt Cavanaugh

The MGCSA gratefully acknowledges the relationship cultivated with the University of Minnesota. Together our efforts have made the UMN an internationally known destination for turfgrass research. The enthusiastic support of the Member Driven Research program has generated material turf managers can use in their turf management programs today. Kudos on a solid partnership. This is the second year of the wetting agent trial developed through the Member Driven Research initiative. In 2014 we expanded the treatment list and applied the wetting agents as season-long programs from mid-May to mid-October. This study is focusing on wetting agent's influence on surface firmness and winter health of putting greens, which are potential benefits of wetting agent applications, but both have yet to be demonstrated in research. Table 1 shows the products that are being used this year.

Table 1: Wetting agent rates and manufacturer used in surface firmness and winterinjury of creeping bentgrass putting greens. Products with two numbers indicatethe initial application followed by the subsequent applications.

Treatment	Rate (oz/M)	Manufacturer
AquiFlo	4	WinField
AquiCare	3	WinField
Cascade Plus	4	Precision Laboratories
Duplex	1	Precision Laboratories
Cascade Plus/Duplex	4/1	Precision Laboratories
Fleet	8	Harrell's
Revolution	6	Aquatrols
Tournament Ready	4	Kalo, Inc.
Dispatch Sprayable	4	Aquatrols
Primer Select	4	Aquatrols
Sixteen 90/Dispatch Sprayable	4/1	Aquatrols
Sixteen 90	4	Aquatrols
TriCure AD	2	Mitchell Products



Picture 1: Throughout the study, spray volume was set at 2 Gal/M and all treatments were immediately watered in with 0.25 - 0.35 inches of water.

In past research updates we have been putting wetting agents into types or classifications based on the function they are perceived to be performing, either holding water or allowing water to penetrate or even both (kind of like saying jumbo shrimp or pretty ugly). You have most likely seen the words hydration, retention, infiltration, penetration, and drainage to quickly and easily describe a wetting agent's function. It is easy to think that a product classified as a water holder would likely have a softer putting surface and a product allowing water to penetrate would have a firmer putting surface, but do these classifications have any validity and should they be considered when purchasing a wetting agent?

We recently contacted several wetting agent manufactures asking them to better clarify a few products. We were trying to learn more about the products being tested. It became very clear through several conversations that putting wetting agents into categories based on marketing classifications may be an over simplification, even though we see these classification used in many situations. So, we initially want to take a look at what exactly is going on with this classification system with wetting agents. Here are two conversations with two wetting agent manufacturers to give you a better understanding of why this needs to be talked about more.

Manufacturer 1 Conversation:

Question #1: "Is 'Perfect Greens Wetting Agent' an infiltration type wetting agent (moving water through the profile), a retainer type wetting agent (keeping the profile wet) or both (if that is possible)"?

Manufacturer: "Regarding your question, these designations you list are often erroneous as labels for wetting agents and just as often initiated in the market by companies using labels such as these to misrepresent products (both their own favorably and their competitors unfavorably)".

Question #2: "This may be true, but superintendents often purchase and talk about these products based on these basic designations which have been created by the industry based on known or seen attributes of a chemistry. Even though there is no official classification system (like a mode of action), this is often the only thing a superintendent has to go on".

Manufacturer: "The chemical basis for wetting agent classification is meaningless yet the industry bought into it to a large degree".

Manufacturer 2 Conversation:

Question #1: "Is 'Super Fantastic Wetting Agent' an infiltration type wetting agent (moving water through the profile), a retainer type wetting agent (keeping the profile wet) or both (if that is possible)"?

Manufacturer: "The terms you used are marketing terms and classifications and not chemical classifications. Most products can improve infiltration and increase volumetric water content as a result of treating soil water repellency, so it is not as easy as saying something is a 'penetrant' or 'infiltration agent' and something else is a 'retainer' or 'hydration' product. It is not as black and white as that, and I think these marketing terms lead to a lot of confusion in the market place". Both conversations indicate these classifications probably should not be used and cause confusion, but they are still all over the marketing of these products. We can probably agree that simple statements should not be thrown around about wetting agents due to the fact that they can react very differently from course to course or even green to green, but what else do we currently have to go on? There is no mode of action for these products like we see with a plant growth regulator like trinexapac-ethyl. We understand where trinexapac-ethyl is targeting the plant and how the plant will react which differs from a product like mefluidide. Registration with the EPA is also not necessary (some states require a little registration), meaning you don't really know what is in the product which results in a cloudy market.

One manufacturer said "every single wetting agent works in terms of reducing surface tension, but the detail given for irrigation frequency and amount are lacking on product labels" which can cause products to work differently than expected. An additional conversation said that "It would be ideal for us to make a different wetting agent for every situation based on soil conditions and wanted attributes from the product, but this is not feasible. So, we have to make a product that works for most situations". One of the most interesting comments was "In a sand based green, the role of a wetting agent is to achieve the level of water flow and holding that was there on day one of construction. When sand is mined it does not contain the organic acids that cause many of the water issues that we see in a sand based system."

In figure 1, you will see a word cloud that is made up of marketing sell sheets for products in this wetting agent trial (Figure 1). We removed some obvious words such as water, soil, wetting agent and a few others, but left the other words that make up the descriptions of these products. The larger the word, the more it was used in the marketing sell sheets. This gives you a quick representation of what many of these wetting agents try to focus on in terms of their marketing.

Keith Karnok published an article in the July 2013 issue of Golf Course Management titled "Wetting agent chemistry: Who cares?" (Karnok, 2013).



Figure 1: Word cloud built on the marketing sell sheets of the wetting agents used in this trial. The larger the word the more often it was used in the marketing sell sheets.

Some of the highlights include:

1. Who cares about the chemistry? The only question should be, "Does the product perform as the manufacturer claims?"

2. "A chemical classification system of wetting agents published by some wetting agent companies...are based on the known or suspected chemistries of certain wetting agents, and the published charts usually provide the mode of action or performance characteristics for each class of chemistries listed". However, "there is no scientifically published classification system for turfgrass wetting agents".

3. "One reason such an official system does not exist is that it is nearly impossible to know the exact chemical makeup of a wetting agent without reverse chemical engineering of each wetting agent or without each company revealing

the chemical makeup of its wetting agents".

4. Wetting agent results for the same product can vary greatly from year to year or by location and often have similar results regardless of said chemical classification.

5. Wetting agents variations can be from many factors such as "rates of application, amount of carrier water, amount of irrigation applied after application, time between wetting agent application and irrigation afterward, time of day of application, soil type, degree of soil water repellency, depth of water repellency, amount and types of thatch, mat and/ or soil organic matter content, turfgrass species, air temperature, soil temperature, sunlight, soil pH, water pH, irrigation water quality, formulation, spreader/sprayer calibration, irrigation system uniformity, and so on".

This certainly does not clear the waters for us on what these classifications really do in terms of response in the field, but this trial will take an initial look at the topic.

The Trial

There is much discussion about the surface firmness and winter health benefits that wetting agents may provide, but to date nothing has been published on the topic. With this member driven research project we hope to answer these questions. The 2013 data showed very little difference in surface firmness between the products and absolutely no benefit or negative effects on winter health; we observed complete health following winter at the study location. With the increase in products during 2014 and applications being based on season-long program, we were able to see more differences related to surface firmness, and possibly some answers to winter benefits. Remember that for this trial, we are not looking at how these wetting agents perform on localized dry spots or how they perform in terms of wetting uniformity.

We are aware of only two additional research projects that have assessed wetting agent influence on surface firmness of putting greens, and there are no research studies that have evaluated the impact related to winter health. The two firmness study results have never been published. In 2007, Moeller et al. submitted an abstract to the Crop Science Society Conference titled "Putting surface hardness as affected by wetting agent applications." These researchers found no differences in the surface firmness of putting greens following the application of three commercially available wetting agents. Dr. Doug Karcher also evaluated the influence of eight wetting agent products on the surface firmness of putting greens in Arkansas and found no differences in firmness based on treatment (unpublished data). He concluded by saying, "(wetting agents) appear to have little effect on putting surface performance".

We know that there must be some influence related to wetting agent applications and surface firmness, and perhaps the influence may be more apparent under wet or dry soil moisture conditions. With that, this study was initiated to look at the season-long influence of wetting agents on putting surface performance under a wide range of conditions. For a more comprehensive review of wetting agent research, see the article by Horgan and Bauer (2013) titled "Soil



Picture 2: Initiation of the water drop penetration test to evaluate wetting agent residual after a late fall application.

wetting agents: tools for every superintendent's arsenal" in the July 2013 issue of Hole Notes.

Materials and Methods

This study was conducted at the Turfgrass Research Outreach and Education Center, in St. Paul, MN on a 12 year-old USGA green seeded with 'Alpha' creeping bentgrass in 2011. Treatments were applied every 4 weeks starting on May 14th, 2014 through October 19th, 2014. Treatment dates were May 14th, June 11th, July 9th, August 6th, September 3rd, October 1st and a final application before blowout on October 19th. Spray volume was set at 2 Gal/M and all treatments were immediately watered in with 0.25 - 0.35 inches of water. Data collection consisted of soil moisture readings to determine volumetric water content with a FieldScout TDR 300 Soil Moisture Meter (Spectrum Technologies, Aurora, IL). Surface firmness was determined with a Clegg Impact Soil Tester 0.5 KG model #95048A (Lafayette Instruments, Lafayette, IN). The Clegg is designed to measure the hardness or shock absorption properties of a surface. The basic principle behind the Clegg Impact Soil Tester is to obtain a measurement of the deceleration of a free falling mass (the hammer) from a set height onto a surface. Chlorophyll index was determined using the Field Scout CM1000 (Spectrum Technologies, Aurora, IL). Turf quality was visually assessed on a 1-9 scale with 6 being minimally acceptable turf. The treatment area was fertilized weekly at 0.10 lbs. of nitrogen/M. Plots were mowed at 0.125 inches 5 times per week.

Results

As you read through the results be sure to keep in mind the fact that results for the same products used in different university trials can vary greatly, even in the one you are reading about now; this makes wetting agent research very difficult and also something you should be a little skeptical of. Depending on the particular graph or rating date that we show you, the results may vary. We have chosen to display individual rating dates for specific extreme moisture conditions, both wet and dry, because these are situations where we were really able to see some of the differences related to surface firmness and volumetric water water content. We also think these graphs are great representations of how these wetting agents were performing in the field under the various conditions.

Surface Firmness and Volumetric Water Content

Fast and firm, that's the way golfers say they want it. However, environmental conditions and the type of playing surface you have can make this a little difficult. To manage this better, many superintendents turn to wetting agents to provide a firmer playing surface even when there is excessive moisture. Is this possible? Product advertisements certainly make a good claim with phases such as; "Resist excessive water retention at the soil surface while maintaining optimal moisture levels in the root zone to provide a firm, healthy playing surface", "Provides a firmer, faster playing surfaces" and "Produces drier and firmer putting surfaces under wet and dry conditions". This trial was designed to give MGCSA members an idea of how these products perform in terms of surface firmness and volumetric water content.

To do this we took weekly ratings from May 14 to October 19, 2014. During this time period we had a wide range of environmental conditions that caused a very dry rootzone and a very wet rootzone with volumetric water content measurements ranging from 7.08% to 25.68%. This allowed us to see how these products performed over a wide range of moisture conditions.

Wet Conditions

Firmness

Under wet conditions AquiCare provided a firmer playing surface compared to Duplex, Sixteen90, Revolution, TriCure and Primer Select which had a softer playing surface (Figure 2). There was a second tier of Fleet, Cascade Plus and the combination of Sixteen90/Dispatch Sprayable that provided a firmer playing surface than TriCure and Primer Select (Figure 2). AquiFlo, Cascade/Duplex combo, Dispatch Sprayable and Tournament Ready were statistically the same to all treatments firm or soft (Figure 2). The untreated control was statis-

tically the same to all treatments except Primer Select which provided a softer playing surface (Figure 2).

Volumetric Water Content

Under wet conditions, Cascade Plus had a lower volumetric water content compared to TriCure, Duplex and Revolution (Figure 3). There was a second tier of the combination of Sixteen90/Dispatch Sprayable that had a lower volumetric water content compared to Revolution (Figure 3). Fleet, the combination of Cascade Plus/Duplex, AquiCare, Sixteen90, AquiFlo, Tournament



Figure 2: Putting Surface Firmness on June 20, 2014 under wet conditions measured with the Clegg Hammer. Moisture in the five days leading up to data collection on this date totaled 5.21 inches. The previous 14 days totaled 6.52 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.



Ready, Dispatch Sprayable, and Primer Select were statistically the same to all treatments (Figure 3). The untreated control was statistically the same to all treatments.

Figure 3: Volumetric Water Content on June 20, 2014 under wet conditions measure with the FieldScout TDR 300 Soil Moisture Meter. Moisture in the five days leading up to data collection on this date totaled 5.21 inches. The previous 14 days totaled 6.52 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

Dry Conditions

Under dry conditions the combination of Sixteen90/Dispatch Sprayable and Duplex provided a firmer playing surface compared to AquiCare, Revolution and Tournament Ready which had a softer playing surface (Figure 4). There was a second tier of Cascade Plus that provided a firmer playing surface compared to Revolution and Tournament Ready. Dispatch Sprayable, Fleet, the combination of Cascade Plus/Duplex, AquiFlo, Primer Select and TriCure were statistically the same to all treatments firm or soft (Figure 4). The untreated control was also statistically the same to all treatments (Figure 4).



Figure 4: Putting Surface Firmness on July 24, 2014 under dry conditions measured with the Clegg Hammer. Moisture in the five days leading up to data collection on this date totaled 0.00 inches. The previous 14 days totaled 1.74 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

Volumetric Water Content

Under dry conditions, all treatments were statistically the same in terms of volumetric water content (Figure 5). This is most likely due to the severe dry down conditions that occurred on the putting surface. When there is very little water in the soil profile you will find very little differences in volumetric water

content. However, there were treatment differences for turfgrass color under these dry conditions (Figure 6). Due to the dry conditions, Cascade Plus had the lowest chlorophyll index readings which was statistically different to half of the treatments (Figure 6).



Figure 5: Volumetric Water Content under dry conditions on July 24, 2014 measure with the FieldScout TDR 300 Soil Moisture Meter. Moisture in the five days leading up to data collection on this date totaled 0.00 inches. The previous 14 days totaled 1.74 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

Member Driven Research



Figure 6: Chlorophyll Index of the Putting Surface vs. Volumetric Water Content on July 24, 2014 under dry conditions measured with the FieldScout TDR 300 Soil Moisture Meter and the Field Scout CM1000. Moisture in the five days leading up to data collection on this date totaled 0.00 inches. The previous 14 days totaled 1.74 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents. Letters for this graph are indicating differences with chlorophyll index.

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Average Conditions

Under average conditions (looking at moisture levels between the wet and dry conditions) the results are a little more difficult to quantify. There was adequate moisture for proper turf growth, but treatment areas were not too firm or soft. With these conditions we saw products perform very differently. For example, on July 3rd Fleet provided a firmer playing surface compared to AquiCare, Duplex, Revolution, Sixteen90, Tournament Ready, Primer Select and Tricure, Dispatch Sprayable, the combination of Cascade Plus/Duplex, the combination of Sixteen90/Dispatch Sprayable and AquiFlo were statistically the same to all treatments firm or soft. The untreated control was also statistically the same to all treatments (Figure 7). However, on July 3rd under average conditions in terms of volumetric water content in the soil profile, all treatments were statistically the same just like in the dry conditions (Figure 8).



Figure 7. Putting Surface Firmness on July 3, 2014 under average conditions measured with the Clegg Hammer. Moisture in the five days leading up to data collection on this date totaled 0.98 inches. The previous 14 days totaled 3.64 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.



Figure 8: Volumetric Water Content under average conditions on July 3, 2014 measure with the FieldScout TDR 300 Soil Moisture Meter. Moisture in the five days leading up to data collection on this date totaled 0.98 inches. The previous 14 days totaled 3.64 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

On July 18th (an additional average conditions day), AquiCare, Duplex, Dispatch Sprayable, Sixteen90, the combination of Sixteen90/Dispatch Sprayable, Cascade Plus and AquiFlo provided a firmer playing surface compared to Revolution (figure 9). The combination of Cascade Plus/Duplex, Fleet, Tournament Ready, Primer Select and TriCure were statistically the same to all treatments firm or soft. The untreated control was also statistically the same to all treatments (Figure 9). On July 3rd, there were no statistical differences for volumetric water content, however on July 18th, there were many differences. Under average conditions, Cascade Plus had a lower volumetric water content

compared to Revolution, the combination of Cascade Plus/Duplex, and Primer Select (figure 10). AquiCare, Sixteen90, AquiFlo, Dispatch Sprayable, Tournament Ready, TriCure and Duplex were statistically the same to all treatments. The untreated control was also statistically the same to all treatments (Figure 10).



Figure 9: Putting Surface Firmness on July 18, 2014 under average conditions measured with the Clegg Hammer. Moisture in the five days leading up to data collection on this date totaled 0.82 inches. The previous 14 days totaled 2.33 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

"Wetting agents are tools that we use to gain control of water in a wide variety of conditions which is no easy task. Looking at the extremes of having a wet soil profile and a dry soil profile in this trial showed differences in how products performed in relation to these conditions."



Figure 10: Volumetric Water Content under average conditions on July 18, 2014 measure with the FieldScout TDR 300 Soil Moisture Meter. Moisture in the five days leading up to data collection on this date totaled 0.82 inches. The previous 14 days totaled 2.33 inches. Different letters indicate significant differences by Fisher's least significant difference ($\alpha = 0.10$) among wetting agents.

Materials and methods

Winter Injury

To conduct the WDPT, three soil cores 0.75 inches in diameter and 2.5 inches deep, were collected from each replicated treatment. Soil cores were allowed to air dry at room temperature for two weeks to simulate hydrophobic conditions (Picture 3). After the two week drying period, cores were placed horizon-tally and a droplet of water was placed at 0.39, 0.98, 1.57 and 2.17 inches along Page 60



Picture 3. Above, water droplet penetration testing (WDPT) upon two soil samples taken in the spring of 2015.



Figure 11: Time in seconds it took for a water droplet to penetrate a soil core at a depth of 0.39 inches.

the core length. The time (in seconds) for the water droplet to completely enter the soil core was then measured using a stopwatch.

Results

At the 0.39 inch depth, which was just below the soil thatch interface, Duplex and the untreated control had significantly slower water droplet penetration times compared to the rest of the treatments (Figure 11). At the 0.98 inch depth, AquaFlo was significantly slower with the water droplet entering the soil core compared to nine other treatments (Figure 12). At the 1.57 inch depth, Tournament ready was significantly slower with the water droplet entering the soil core compared to Cascade Plus, Fleet, Revolution, and the com-







Picture 4. Hydrophobic conditions in the spring present unique challenges. Photo by James Bade

bination of Cascade Plus/Dupex (Figure 13). At the 2.17 inch depth, all treatments were statistically the same in terms of the water droplet entering the soil core (Figure 14).

The first three depths all had significant differences between products. However, four products at these first three depths were always significantly different from the slowest penetrating treatment at each depth. These four products were Cascade Plus, Fleet, Revolution and the combination of Cascade Plus/ Duplex. These treatments consistently provided quicker water drop penetration times which indicates these products are still present in the soil profile twenty-one weeks after the last application. Theoretically, by creating better moisture penetration, turf surfaces would have the ability to better handle excessive amounts of water due to snow melt or rain events during the winter season. An additional benefit of this information is dealing with infiltration issues early in the season. It can be common to see water infiltration issues



Figure 13: Time in seconds it took for a water droplet to penetrate a soil core at a depth of 1.57 inches.

in the early spring (Picture 4) and this can be even more critical during a dry spring like we are dealing with now. From this study we are finding that wetting agents can persist over the winter months and into the spring, which could help with infiltration issues and adequately restore moisture in the rootzone.

Discussion

Wetting agents are tools that we use to gain control of water in a wide variety of conditions which is no easy task. Looking at the extremes of having a wet soil profile and a dry soil profile in this trial showed differences in how products performed in relation to these conditions. There are several products that consistently provided a firmer playing surface which can be attributed to their low volumetric water content. There are also products that consistently provided a softer playing surface due to the higher volumetric water content. There are also several products that seemed to fluctuate with the environmental conditions. For example, AquiCare under wet conditions on June 20th had a firm playing surface due to a relatively low volumetric water content during these wet conditions. However, when it turned dry, AquiCare changed to have a relatively softer playing surface due to a relatively higher volumetric water content. This has been seen in other research in which products had higher moisture content in dry conditions and lower moisture content in wet conditions (Soldat et al., 2010) However, under the average conditions, AquiCare provided differing results. Conclusions under average conditions, were not as defined on how the products performed. We saw a similar clustering of prod-



Figure 14: Time in seconds it took for a water droplet to penetrate a soil core at a depth of 2.17 inches.

ucts, but products performed a little differently with these average conditions. There also seems to be some potential benefits to using season long applications of wetting agents with particular attention being paid to the last late fall application in terms of potential reduction in winter injury. There are products in this trial that point to still being viable in the soil allowing water to move away from the soil surface, but also provide some much needed rewetting capabilities coming out of the winter and into a dry spring.

There is plenty of information in this Member Driven Research report. Remember to choose the wetting agent that is right for you by combining needs versus experience and data provided by this report, but also remember that wetting agents react differently year to year and from green to green which has also been seen with other research (Throssell et al., 2005a, 2005b). Please feel free to ask questions about the data that is presented in the report and how it can be used to better choose a wetting agent that is right for your course.

Literature Cited:

Horgan, B., S. Bauer. 2013. Soil wetting agents: Tools for every superintendent's arsenal: An objective and in-depth review of over five decades of research. Hole Notes. July. 46(6): p. 20-39.

Karnok, Keith. 2013. Golf Course Management. July. 81(7): p. 70, 72,74,76.

Moeller, A., C.A. Bigelow., J.R. Nemits, G. Hardebeck. 2007. Putting green surface hardness as affected by wetting agent applications. Abstracts: 2007 International. Annual Meetings [ASA/CSSA/SSSA]. P. [1].

Soldat, D.J., B. Lowery, and W.R. Kussow. 2010. Wetting agents affect soil moisture uniformity in sand putting greens. Golf Course Management: 78(8):76-82

Throssell, C., et al. 2005a. GCSAA-USGA wetting agent evaluation: Update. Golf Course Management. 73(8):71-83.

Throssell, C., et al. 2005b. GCSAA-USGA wetting agent evaluation. Golf Course Management. 73(4):52-91.



Spray Technology Products





Bayer Environmental Science

April 28, 2015

MGCSA Assistant' Committee Presents:

Spring Assistant Superintendent Seminar Lunch provided by Mike Kelly and Bayer Environmental Science

Where? Frost Inc. in St. Croix Falls Wisconsin, hosted by Assistants Mark Michalski from TPC Twin Cities and Todd Kranz from Windsong Farm GC, Mike Kelly of Bayer Environmental Scientific and Ken Rost of Frost Inc.

7:30-8:00 AM	Registration, coffee/networking
8:00-11:00 AM	Ken Rost, GPS Sprayers, Programming and spray
	operation systems
11:00-11:45 AM	Lunch provided by Bayer Environmental Science
12:15-3:00 PM	Nine holes of golf across the street at the St. Croix
	Valley Golf Course, an amazing golf experience

Cost of the day including coffee, donuts, lunch and golf : just \$15

Please use the Universal Registration form to sign up call or email Jack at 651 324 8873 or MGCSA.org for more information.

It just wouldn't be the same without you.

Within the Leather

by David Kazmierczak, CGCS

I was having a conversation with our head pro, Tom Wahl recently and after

the important business we had to discuss about the course, the world and other critically important-but-not-really things, the real fun part of the conversation about my job commenced.

"How hard can it be? All you got to do is throw some fertilizer on it, water it and mow it," he said, with tongue firmly in cheek. I think this is after I called him a glorified sock peddler. I'm glad we have a very solid relationship.

> But our bantering and ribbing of each other a month ago got me thinking. How many of the people that we prepare the golf course for think the same thing? I'm afraid the answer is more than we care to know, which is definitely not in our

favor.

Golf course Superintendents tend to be a quiet bunch. The thought has traditionally been that we are not to be seen nor heard but still deliver top playing conditions. We are all Carl Spackler like- dirty, kind of dumb and definitely not refined in any way, shape or form. Thankfully, these stereotypes have been broken for the most part over the last quarter century, and increasingly we are viewed as the most important manager at the golf facility, capable of wearing many hats and able to adapt and multi-task better than anybody. But still, I think there is a segment of the golfing population that still doesn't get what we really have to do. So, I will attempt to tell them, in my own special way, and if you feel free to enlighten one of these non-superintendent cognizant types with this letter, feel free to do so.

Dear golfer:

I am (insert your name here), your friendly golf course superintendent.

I take care of this golf course you love to play and escape from your busy world at. While you play and enjoy the day, I want you to know a few things about what it takes to produce the conditions you are enjoying.

First off, the ground that you are walking on and excavating on occasion contains millions of tiny living things. Grass is alive, in case you hadn't noticed or thought about it. Like all living things, it takes a lot of care to keep it healthy, happy and playable. Taking care of it takes a skill that is acquired through both education and years of training. Even when everything is done right, things can and will go wrong for any number of reasons, some of which are completely out of my control.

I am in charge of ensuring the grass has the right amount of food and water, but not too much. I have to make sure the plants are protected from any number of things including insects, fungus, weeds, varmints, bacteria and bad micro-organisms. It is critical that I understand when they will do harm and what measures to take to stop them, and it can be very

challenging.

I am in charge of any number of employees, which I must train into a single working unit, able to handle a variety of duties and responsibilities. These employees will range from 16 to 80 years old and anywhere in between, and they will hail from any cultural or geographical background. They will also have to conduct their business getting paid minimum wage or slightly more, and I will have to somehow motivate them to do so at a very high level. I am to accomplish all this with little to no disruption of your golf game, no matter when you are playing, which is nearly every hour the sun is shining. I must adhere to and know national, state and local regulations to accomplish this, which constantly change and are ever more restrictive. In no particular order, I am an agronomist, carpenter, hydrologist, chemist, HR official, safety co-ordinator, trainer, accountant, coach, mentor, mechanic, technical expert, computer literate, communications

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expert, horticulturalist, operator, laborer, irrigation expert and meteorologist.

I am more than likely, the most highly educated person and diversified individual employed at the facility, including anyone in upper management. That said, I probably am rather humble in ideas and prefer to go about my business without fanfare and don't need constant direction or admiration. Because you see, I truly love the job I do, the course I work on, the people I work with and can think of nothing I would rather do to earn a living, most of the time. When is it I am not in love with my job and all that encompasses it? Well.....

In no particular order: Ball marks un-repaired, hard-headed greens committee, un-cooperative pro shop, unfilled divots, surprise golfers on the back nine, unraked bunkers (by players), unrealistic expectations, missed putts blamed on workers, carts driven past no cart signs, sat on divot boxes, errant candy bar wrappers, golf shoes dragging on greens, sunflower seeds, rakes not put in/out of bunkers, constant

questioning of aerification practices, perplexing adoration of particular trees and drunken, golfing idiots just to name a few. (If you look closely, you will notice all of the above annoyances can be fixed by you the golfer.) So in closing, I simply and humbly ask that you take a second while enjoying your round and think about what it takes to provide you with this lovely course you are playing on, ask yourself what you can do to help us just a little bit to maintain this level of excellence, and remember that high performance turfgrass doesn't just happen by accident. It takes a lot of work, know-how, and yes, love to make it what you enjoy on a consistent basis.

Respectfully submitted,

Joe Superintendent

Good luck getting the sock peddler to post that in the pro shop.

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