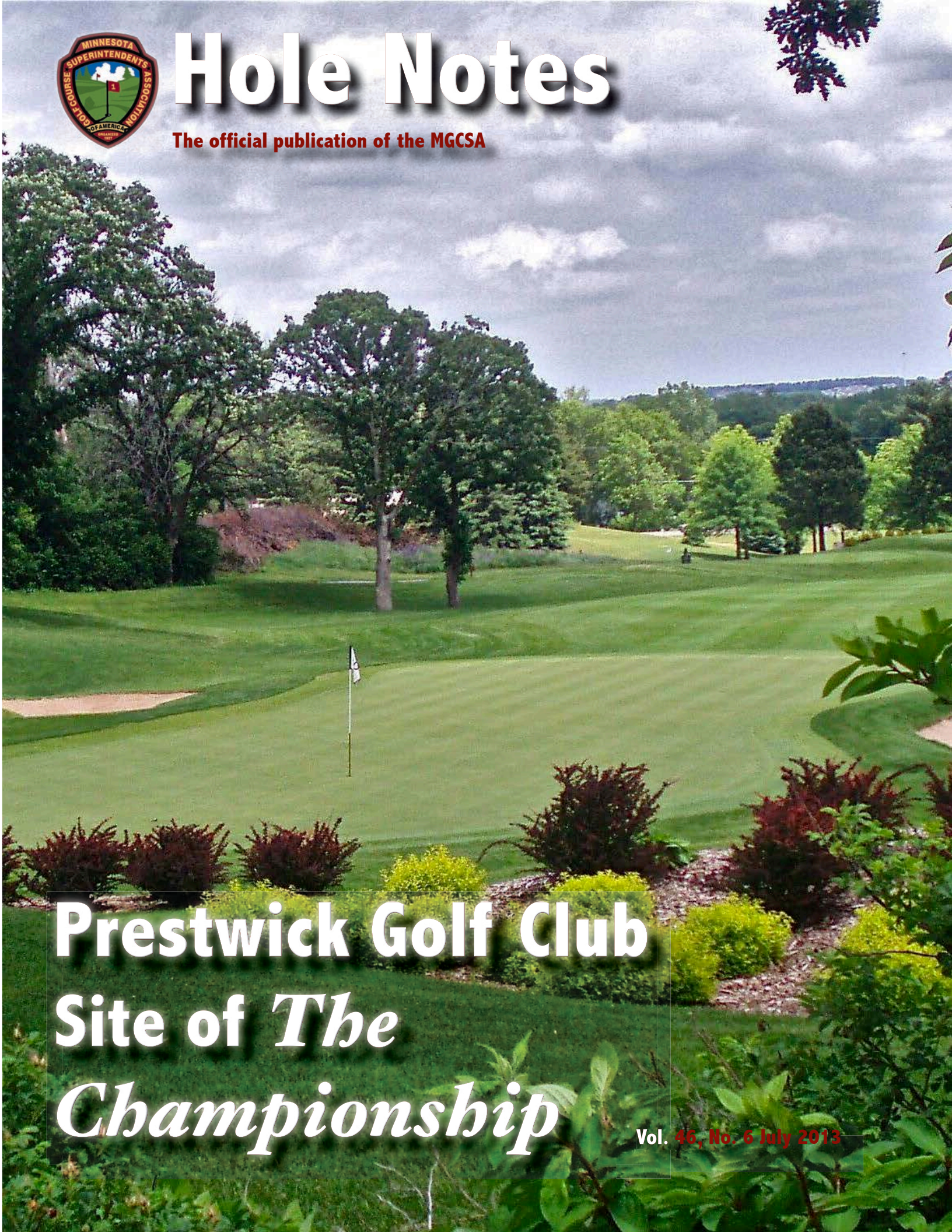

Hole Notes

The official publication of the MGCSA

Prestwick Golf Club Site of *The Championship*

Vol. 46, No. 6 July 2013

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August 13
The Championship
Prestwick Golf Club
Host Dave Kazmierczak, CGCS

October 7
The Wee One
Brackett's Crossing Country Club
Host Tom Proshek

October 15
Fall Shoot Out
Minnesota Horse and Hunt Club
Host Superintendent Bill Gullicks
Bellwood Oaks Golf Club

November 20
Assistant's Professional Forum
Pinz St. Louis Park
Host Assistant Superintendent
Casey Andrus
Interlachen Country Club

EDITOR
DAVE KAZMIERCZAK, CGCS
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The amazing cover shot is hole 3 at Prestwick Golf Club, site of the 2013 MGCSA Championship. Thanks to Steve Sandberg for his photo capture. Join the fun on August 13th!

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Hole Notes (ISSN 108-27994) is digitally published monthly except bimonthly in November/December and January/February by the Minnesota Golf Course Superintendents' Association, 10050 204th Street North, Forest Lake, MN 55025. Jack MacKenzie CGCS publisher. Please send any address changes, articles for publication, advertising and concerns to jack@mgcsa.org.

Presidential Perspective

by Scottie Hines, CGCS Superintendent at Windsong Farm

Welcome to summer! Wow this last week has just been a scorcher! Heat advisories almost all week. This should set us up for another bout of severe storms yet again? I know I chatted with a few local superintendents after last weekend's Biblical rain. Windsong took four inches of rain in just three short hours. Many others had more than that. I hope everyone survived with little issue. Trying to finish a landscape project here has not been fun.

How about the mosquitoes and gnats? I have never used as much bug spray as I have this year. They are absolutely atrocious. Have you ever seen them this aggressive? There are spots here that if you stop it is a matter of seconds before you are covered with hundreds of bugs. I saw a news report that stated the mosquito population was up 300%. Don't you wish our salaries reflected that kind of raise for working in hazardous conditions?

For a year that started late and was fairly tame early, it has become an exercise in managing heat, rain, more heat, more rain, mosquitoes, gnats, staff health and attitude and family life. It suddenly feels like it should be late July! The only thing I have seen to make it a bit less stressful is we have had little to no disease issues. As I have said for years…Mother Nature has a sneaky way of meeting the average.

Other than the weather and insect issues, not much has changed from the last message. That said, there was a very interesting GCSAA Government Relations Update Webinar yesterday. It updated much of the issues I have been commenting on as the year has progressed. The key topics were the Farm Bill and Immigration Reform. Both sides have passed their version of the Farm Bill. The NPDES fix is included on one side and absent from the other. Only time will tell where it will land. Immigration Reform was another big topic. Once again, that looks as if it will stall and leave us in the same boat we are currently in.

I wish everyone the best as we trudge through this heat wave. Stretches like these are a grind on everyone. Superintendents, assistants, interns and families are all affected by these weather episodes. Make sure your staff is getting the needed rest to keep them as sharp as possible. A staff that is healthy and sharp makes managing this weather much easier than if they are burned out, unhappy and snippy with each other. Take the time with family as well. It is hard to come home after 12-14 hours in this heat and be a fun dad or mom but it is important to make the effort at the very least.

MGCSA CHAMPIONSHIP

Prestwick Golf Club

Woodbury, Minnesota

Bigger Purse, More Places Awarded

Tuesday, August 13, 2013

HOST SUPERINTENDENT: Dave Kazmierczak, CGCS

FIELD LIMITED TO 120 PLAYERS GOLF, Box Lunch and Fiesta Dinner: $100

ENTRY FEE INCLUDES: LUNCH, RANGE BALLS, GOLF, CART, FIESTA DINNER AND AWARDS

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5:00 pm..... Fiesta Dinner & AWARDS

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A tribute to Wayne Otto, CGCS

Tournament on October 7
Brackett's Crossing Country Club

Host Superintendent Tom Proshek

In Bounds

by Jack MacKenzie, CGCS

A man fond of sandals, I had forgotten the precious and blissful feeling of enrapture upon winning and wearing a pair of new, low cut socks at a recent golf outing. Black, unisex and one-size-fits-all, my lower digits were dancing with joy when I tried them on for a test run at home.

Protective, yet unencumbered, warm though not hot, snuggled but flexible, my feet were in summer nirvana. New socks, such a luxury!

In my youth, as a recently emancipated man, free from the bonds of parental control, my fetish with new socks began. In line at the J.C. Penny store during the Christmas rush, I spied a "three for" pack of thick, foot formed athletic socks. An impulse buy? Perhaps, but oh what an incredible substitute for the thin and striped white tube socks I had been accustomed to for all of my teen years.

There was actual density surrounding my feet. Toes jiving in the front and heel firmly housed in the rear, my new socks were just short of "pro night", another fine memory of mine. Oh what had I done to deserve such a delight?

So easy to ignore, a cinch to forget, out of sight and out of mind, the latest in hosiery too often simply disregarded. Slipping into a new pair of socks is a seldom-discussed ecstasy. Have you ever eaten a "Better Than 'New Socks' cake"? Believe me, it is heavenly.

Each summer, prior to my forays into the wilderness of the BWCA, I splurge upon and buy a new pair of top of the line camping socks. Beyond protection

from the chafe of leather boots, they provide a cushion inside my camp shoe and night-long romance, embracing my feet, buried deep inside my sleeping bag.

Earlier this season, I broke the budget and invested in an over the top pair of Smart Wool Ultimate Hunt and Camp System Lights. They feature a liner crew sock to wick moisture from my feet and a hunting light crew sock for warmth, both of which are constructed with WOW Technology, providing high density zones in the heels and toes, and a Smart Wool Tech Fit system with ankle brace, arch support and a reinforced cushion zone. This sock can't bunch, slip or bind and will always stay in place! The ultimate comfort in all weather conditions, I can barely wait to go north again… maybe I'll just go and slip them on for a little while to take "the edge" off. Sorry, I got a little carried away.

New socks don't smell. I like that. New socks can be relished privately…while in public. Nobody has to know! New socks will develop a personality. Have you ever worn your "lucky socks"? New socks grow old, wear out, become thin, lose their elasticity and finally can be replaced once again with another pair of New Socks.

In the second from the top drawer in my dresser, I maintain my coveted wealth of socks; Gold-Toe, Thorlo, The Worlds Softest Sock, Smart Wool, Zappos, Wigwam, ISM, Nike, Footjoy, Asics and Alpaca. Silk, wool, cashmere, nylon, rayon, blended and cotton. No show, tab, low cut, quarter length, crew, knee-high and over-the-calf. Dress, athletic, holiday, conference, business, casual, camping and sleeping. On occasion my sock drawer will even give safe haven to the lonely lost sock as it awaits the return of it's match.

All this talk of socks remind me of a little limerick that goes like this:

"In days of old, when men were bold…"

Never mind…this is perhaps a better poem with the guys around the campfire.

In Passing:

Life-Long Turf Industry Professional Jack Kolb

Jack Kolb, an icon in the Minnesota golf turf industry, passed away on July 10 in an outpatient Hospice Home in St. Cloud, MN. His family was at his side and he went peacefully. The following is an excerpt from the January 1991 Hole Notes magazine which highlighted Jack's carrier as a recipient of the Distinguished Service Award.

"When Jack Kolb was graduated from high school in 1941, the United States was preparing for war. There was little time to plan a career, so Jack left a job as a Wisconsin cheesemaker near Green Bay and took up work as a shipfitter, building submarines at Manitowoc, Wis. In 1942 Jack was drafted into the Navy and was trained as a torpedoman with the Pacific Submarine Command. Most of his Navy career was spent on Midway Island.

Upon discharge, he enrolled at the University of Minnesota, intent on being a forester; however, he felt that a certain dark-eyed young lady was not about to be a homemaker in a cabin deep in the woods. So, after a change in majors, and 240 credits later, he was graduated with a degree in Plant Industry.

Jack's first job was as a fertilizer salesman with the old Farm Bureau Service Company in 1950. In 1953, Jack was hired by Dr. James Watson and went to work for the Toro company as an agronomist. After a few years and because the pay was better, Jack became golf course superintendent with The Mini-

kahda Club. After 10 years at Minikahda, he moved to Minneapolis Golf Club for a few more seasons. During this time he evaluated the turf industry and the idea of Turf Supply Company was conceived.

Jack left Minneapolis Golf Club on Dec. 31, 1969. Turf Supply Company was born the next day. Not one sale was recorded for the first three months of its existence. During this time his wife, Rajah, and five children under 11 years of age operated on a very low budget. Eventually, the business grew, and the next 21 years saw many new innovations in marketing. One of Jack's hobbies was writing. Several of his articles were published in the old Golfdom magazine. One of his treasured letters is a four-page document from Herb Graff is, editor of Golfdom, commending Jack for his approach on the golf course superintendent's role in the golf industry. "

Mr. Kolb mentored many aspiring turf professionals and will be remembered as a strong leader of the industry.

Congratulations MGCSA Le
Legacy Scholarship Recipi

Contributed By Casey Andrus and Jeff Girard, Members Services Committee

This year the MGCSA is pleased to award two, $1,000 MGCSA Legacy Scholarships, to Zachary Churchill and Allison Dodge, a $1,500 Joseph S. Garske Legacy scholarship to Allison Hable and a $1,500 Garske scholarship renewal to Kyle Kazmierczak.

The Minnesota Golf Course Superintendents' Association offers a Legacy 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.

Winners of this year's MGCSA Legacy Scholarships are:

Zachary J. Churchhill, the son of Joe and Barb Churchill. Joe is a Sales Affiliate with Reinders Inc. Zach is a graduate of Minnetonka High School and is now enrolled at the Normandale Community College. His is currently undecided in his major.

Kelsey C. Dodge, daughter of Vince and Jenny Dodge. Vince, CGCS, is the Superintendent at The Wilderness at Fortune Bay. Kelsey graduated from Ely Memorial High School and is currently enrolled at Concordia College where she is majoring in Graphic Design.

The Joseph S. Garske Legacy award, named after the founder of Par Aide Products Company, Joe Garske, is committed to further the education of children and grandchildren of MGCSA members through financial contributions. This is the 17th consecutive year for these awards. Par Aide is located in Lino Lakes, Minnesota and owned by Steve Garske, son of Joseph.

The late Mr. Garske, who died at the age of 76 in 1982, started Par Aide in

egacy and Joseph S. Garske
ents. Hard Work Pays Off!

1954 with plans to make a "good" ball washer. A foundry man and avid golfer, he knew little about the golf business, tried to sell his ideas for design and tooling to two accessory companies, was turned down by both and so began Par Aide Products Company. The Legacy Scholarship was started in his honor by Steve in 1996.

"I am pleased to have our company provide these scholarships since for many superintendents, providing a college education for their children requires true sacrifice. I am fortunate to have the opportunity and ability to help," Garske said.

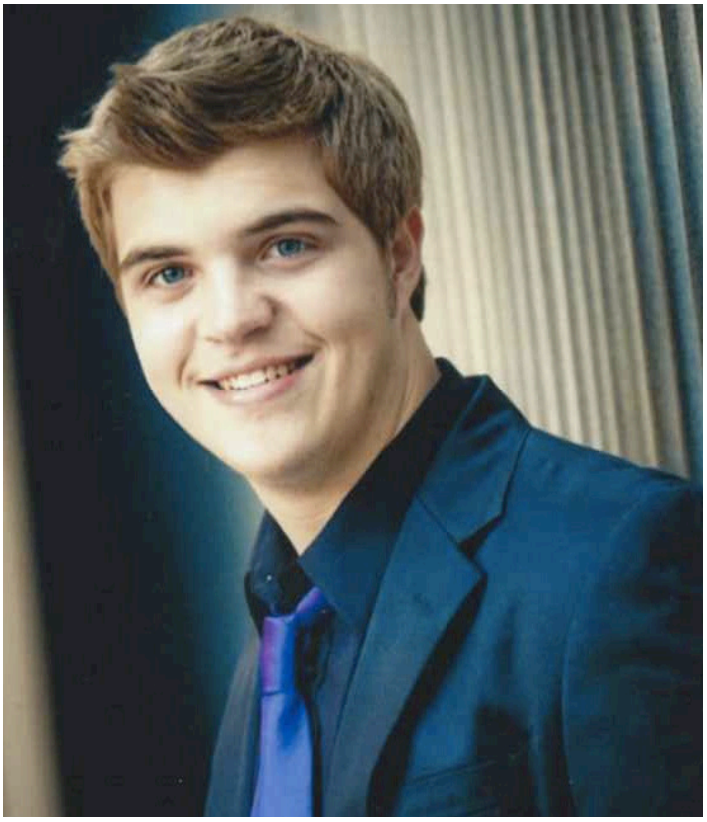
"As a long-time member of the Scholarship Committee some years ago, it always bothered me that we had lots of scholarships available for turf students but nothing for the legacy of current members," Garske said. (Heeding the comments of a long-time Minnesota Superintendent that our committee was working to put him out of a job.) While Steve thought this was a bit of paranoid thinking, it did make him realize that supply and demand works in this industry as well, and if nothing else, an oversupply of eager new superintendents could definitely undermine salaries. However, it was the following premises that motivated Par Aide to initiate a legacy scholarship program:

1) Many Superintendents are underpaid, in my opinion, and they truly work a labor of love. Sending a child to college is likely a real hardship. These same Superintendents who now have college age children were the very ones who had been so responsible for supporting our company through all the years and had helped us attain our success. We wanted to thank them.

2) Our founder, Joe Garske, did not have any formal education and was always conscious of that fact. He had quietly supported at least one young man in gaining a degree.

3) There were lots of turf student scholarships but few if any Legacy awards."

So it seemed obvious to Steve to initiate a legacy program and it was discussed at numerous scholarship meet-



Zachary Churchill

ings. The problem was how to administer such a program. Suppliers to our industry did not want to be in a position of judging one potential recipient/customer against another, and Superintendent members were not comfortable with reviewing personal information and making judgments on each other either. The sponsorship concept lay dormant until we discovered the Citizens' Scholarship Foundation of America, now called Scholarship America, an organization that does nothing but review and award scholarships. It's completely impartial and considers all information confidential. The MGCSA quickly agreed to accept the cost of administration and the Joseph S. Garske Legacy was born.

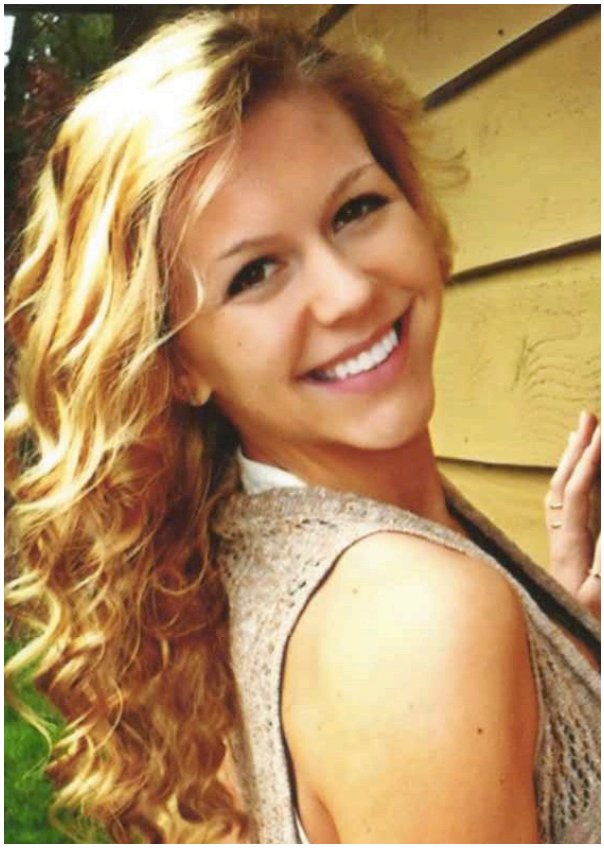
The idea was to provide two two-year scholarships to deserving children of current MGCSA Members. This program is thought to have been successful by all and has been in existence since 1996, helping numerous sons and daughters of Superintendents pursue their college education. Par Aide has continued to prosper and as an expansion of its Minnesota program, it now also offers a similar program nationwide through the GCSAA.

Congratulations to the winners of the 2013 MGCSA and Joseph S. Garske Legacy Scholarships. Thank you members of the MGCSA and especially Steve Garske for enabling these fine individuals to pursue their dreams and aspirations.

Winners of this year's Joseph S. Garske Scholarship are:

Kelsey Dodge

Allison E. Hable, daughter of Jeff and Donna Hable. Jeff is the Superintendent at Phalen Golf Course in St. Paul. Allison is a graduate from the Coon Rapids High School and is currently attending the University of Minnesota, Duluth. Her area of study is general at the current time.



Allison Hable

Kyle Kazmierczak, son of David and Denise Kazmierczak, is the recipient of the Joseph Garske Re-newel. David, CGCS, is the Superintendent at Prestwick Golf Club in Woodbury. Kyle is a graduate of Stillwater Area High School and is currently attending the University of Wisconsin at Madison. His area of study is Nuclear Engineering.

Benefits of Membership in the MGCSA

MGCSA.org: The MGCSA provides its membership an electronic destination. The site offers a broad range of services including latest news, meeting information, important links, local association contacts and meeting schedules, as well as a market place for used equipment or student internships. Links are provided to the Affiliate Members who advertise on the web site.

Education: The MGCSA provides a range of high quality discounted professional education with more than 100 hours of relevant classes at the Northern Green Expo in January each year, supplemented by an extensive program at the Mega Seminar, as well as the annual MGA Spring Turf Forum.

Research: The MGCSA coordinates with researchers at the University of Minnesota's TROE Center to make sure you get the information you need. The association also directs Turfgrass Research Benefit Week, the annual sale of donated tee-times, to raise money for golf turfgrass research. And the association also contributes to The Turf Endowment fund to ensure a continuing program at the University of Minnesota.

Government Relations: The MGCSA provides access to the State Capitol through a continued relationship with the Minnesota Golf Association and other Green Industry Allies. This service keeps your association aware of issues likely to affect golf as they emerge rather than after the fact. This proactive presence also helps us educate legislators and regulators by providing solid information and research findings as they strive to make sound decisions for the good of the whole community. The MGCSA has representation at the Minnesota Nursery and Landscape's 'Day on the Hill' event.

Hole Notes Magazine: The MGCSA provides an award winning professional golf course superintendent association journal. Published ten times each year in a digital format, Hole Notes strives to provide relevant, interesting information that reflects the personality and professionalism of the membership. Links are provided to the Affiliate members who advertise in the magazine.

Membership Directory: At the Member's Only section the MGCSA provides an annually updated listing of names and contact details for every member of the association. This electronic directory puts each within fingertip reach of around 700 allied professionals across the region.

Employment Referral Service: The MGCSA provides a link between the people with jobs and those who want them. The employment referral service is available on-line at MGCSA.org as well as electronically delivered weekly through 'e-updates'.

Email Alerts: The MGCSA uses the internet to provide updates and alerts on urgent matters as they arise so we remain current with issues that may effect you, the industry and the Association.

Scholarships: The MGCSA extends its support to the next generation through an annual scholarship program to assist children and grandchildren of superintendents who have achieved academic excellence.

Wee One Support: The MGCSA annually hosts a Wee One fund raising golf outing with the proceeds going to support this outstanding program that serves those in the goof course turf management industry.

Soil Wetting Agents: Tools for Every Superintendent's Arsenal

An Objective and In-Depth Review of Over Five Decades of Research

Dr. Brian Horgan and Sam Bauer
University of Minnesota Turf Science Extension

The Editorial Staff and members of the MGCSA would like to recognize Dr. Brian Horgan and Mr. Sam Bauer for their contribution of relevant material published in the Hole Notes magazine. This extensive compendium of wetting solution science articles and published papers is a result of the Member Driven Research project initiated by the Research Committee and directed by you, the membership.

A quick search on the topic of "wetting agent" on Michigan State's Turfgrass Information File brings up 1044 articles dating back to a 1946 article written by the USGA Green Section. In this Timely Turf Topic article, the authors discuss wetting agents mixed with DDT to improve dispersion aimed at controlling cutworms, ants, mole crickets, and other insects on golf courses (Grau, 1946). While the use of wetting agents in this case was more for the emulsifying and spreading properties provided, it was around this time that the talk of using wetting agents for soil improvement surfaced.

The research surrounding soil wetting agent use follows a long history of University and industry trials dating back to the mid-1950s when the pioneer Bob Moore of Aquatrols Corp. marketed the first commercially available wetting agent "AquaGro" (Hiscock, 2010). This review focuses on the research surrounding wetting agent use in the turfgrass industry from Bob Moore's 1950 introduction until today. Much study has been conducted in this area, and many superintendents rely on this research and their personal experience to justify incorporating wetting agents into their turfgrass management program. History can provide valuable insight on where we are today with wetting agent use, and it's important to take an objective look at the facts surrounding what these products can provide for your soil and turfgrass.

1955 to 1964

The initial discussion of wetting agent use surrounded the idea that “plain water” could be improved upon, and “making water wetter” would produce a better turf. In fact, in one of the first articles written on the use of wetting agents, Bob Moore mentions “we have been governed by the physical limitations of plain water” (Moore, 1957). Just as today, the primary wetting agents being used to improve soil conditions sixty years ago were non-ionic wetting agents, or those wetting agents lacking an ionic charge. These products were thought to be less injurious to plant tissue, consistent, and more effective.

Around this time the talk of soil moisture tension surfaced. Soil moisture tension is the tendency of water to cling to soil particles. Water with a lower tension has a greater ability to move and replace moisture withdrawn by turfgrass roots. Figure 1 is a graph from Moore, 1957 showing a close relationship between soil moisture tension and root elongation. While this graph looks too perfect and we all know that 100 percent soil moisture is never good for root growth, it puts perspective on an idea that we don’t consider much these days, that is, allowing water to move more freely in our root zones, not just curing hydrophobicity. Reported benefits of lowering soil moisture tension included 1) increase in the availability of water and nutrient solutions, 2) freer movement of water and nutrient solutions, and 3) greater root growth (Moore, 1959). At this point in time, there was little turfgrass research to support these claims.

One of the first wetting agent studies in a turfgrass setting was published by the Soil Science Society of America. Researchers evaluated infiltration rate differences of three commercially available wetting agents when applied to quartz sand (Pelishek et al., 1962). The focus of this study was on the contact angle present between sand columns and the water solution applied to the columns. Pelishek et al. concluded that wetting agents can increase infiltration rates on hydrophobic soils, and there is a beneficial residual effect of wetting agents.

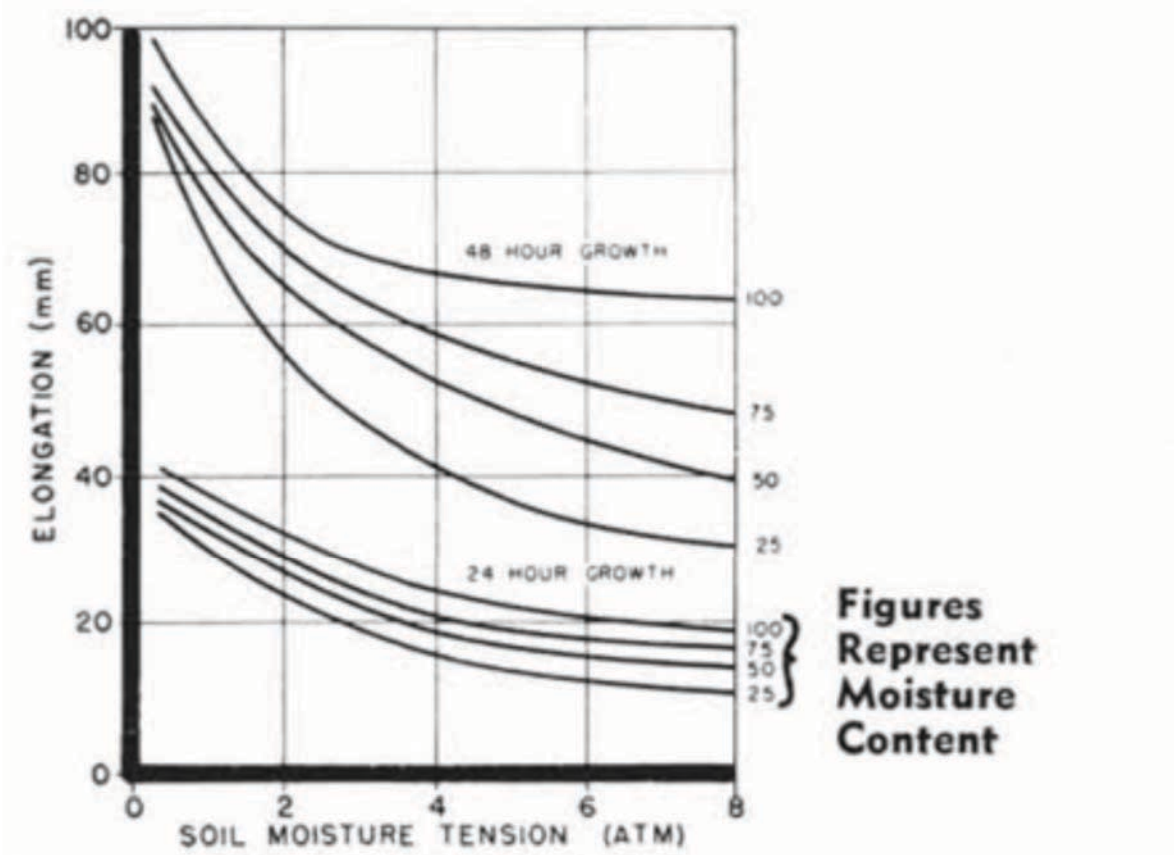


Figure No. 5. Elongation of roots as effected by soil-moisture tensions. Deeper roots are developed under low soil moisture tensions.

(Figure 1. Reference: Moore 1957)

1965-1974

Around the mid-1960s wetting agents were starting to become common tools used by golf course superintendents. Not surprisingly, this is when researchers began to evaluate their effectiveness and place in turfgrass management programs. Roberts (1966) studied the effects of four wetting agents applied monthly to creeping bentgrass, colonial bentgrass, and Kentucky bluegrass, grown both in the field and in a greenhouse at Iowa State University. The "old chemistry" wetting agents used in this study had no effect on turfgrass quality or moisture relations

under field conditions. In the greenhouse, turf grown hydroponically in a wetting agent and nutrient solution showed chlorosis and reduced growth. In this case, increasing surfactant level in the solution caused an increase in toxic levels of copper and zinc concentrations in the turf tissue causing phytotoxicity. It appeared that the soil in the field study was able to bind the wetting agent, in which case no injury was apparent. During this period, the non-ionic surfactants were only considered of value in hydrophobic or difficult to wet soils.

In a three part study conducted by researchers at the University of California-Riverside, soil wetting agents were evaluated with various levels of compaction, irrigation, and soil amendments on common bermudagrass grown in a greenhouse. While this study was fairly complex, strong correlations were made with the addition of wetting agent on improving infiltration of sandy loam soils (40% greater infiltration rates), but not sandy loams modified with 33% either peat, lignified redwood, or calcined clay. Overall infiltration rates on these modified soils were significantly greater than on sandy loam alone, which explains the lack of response from wetting agent additions. Other responses evaluated in this study included compactability, evapotranspiration, top growth, salinity, tissue mineral content, oxygen diffusion rate, and top growth; wetting agent treatments showed little effect on these responses (Morgan et al., 1966; Letey et al., 1966; Valoras et al., 1966).

These same researchers studied the effects of AquaGro and Soil Penetrant 3685 (both polyoxyethylene based) on seed germination, shoot growth, and root growth of creeping bentgrass, Kentucky bluegrass, bermudagrass, annual ryegrass, tall fescue, and barley. This was one of the first studies that demonstrated differences in phytoxocicity among similar wetting agent chemistries. Both root and shoot growth reductions were associated with higher wetting agent application rates, and Soil Penetrant 3685 treated plants were suppressed more than those treated with AquaGro; this was attributed to the higher soil retention of AquaGro and therefore less product present in soil solution (Endo et al., 1969), similar to the idea from Roberts (1966).

In an eight year study, Murray and Juska (1977) studied the effects of several management practices, including wetting agent applications, on thatch accumulation, turfgrass quality, and leaf spot development in Kentucky bluegrass turf established in Maryland. These researchers hypothesized that the wetting agent treatment (AquaGro) would increase thatch moisture levels and therefore increase the rate of thatch decomposition. Over the duration of the study, wetting agent applications had little effect on thatch accumulation or turfgrass quality compared to the untreated control, however leaf spot damage was reduced in plots that were treated with a wetting agent. Leaf spot severity is increased in high moisture environments; therefore the wetting agent's ability to increase soil and canopy dry time, as well as reduce the formation of dew, is most likely the reason for the reduced leaf spot severity. However, Vargas and Detweiler (1980) failed to show this same relationship with leaf spot and AquaGro on 'Pennlawn' creeping red fescue. Also, Otto and Vargas (1984) saw no effect of wetting agent applications on leaf spot or dollar spot severity on Kentucky bluegrass.

After experiencing severely hydrophobic conditions on a newly seeded 'Penncross' creeping bentgrass sand-based experimental putting green, researchers at Ohio State University studied the influence of three commercially available wetting agents (Hydro-Wet, AquaGro, and Grozyme) with or without core aeration on improving soil moisture retention. The hydrophobicity was attributed to an organic coating on the soil particles. Treatments consisting of aeration plus Hydro-Wet or AquaGro performed the best at reducing the severity of the localized dry spot, and these two wetting agents applied without aeration also helped to alleviate the symptoms. Grozyme treatments showed no effect on reducing turf injury caused by hydrophobic soils (Wilkinson and Miller, 1978).

Numerous studies on the use of wetting agents were being conducted during this time period by institutions such as Michigan State University and University of California-Riverside. While these studies were published in field day or conference reports and not peer-reviewed journals, much of our knowledge on

the use of wetting agents was developed from these types of investigations. For example, Rieke (1974) demonstrated up to a 73% soil moisture increase one month after wetting agent applications on a hydrophobic fairway. This moisture increase resulted in a significant improvement in turfgrass quality for approximately two months after treatment in Michigan. The residual effects of AquaGro and Hydro-Wet were evaluated one year later. All of the wetting agent treated plots continued to hold more water than the untreated check, with the best treatment (Hydro-Wet applied at 32oz/1000ft2) holding 74% more water over one year after a single application in July. Turfgrass quality ratings closely reflected the increase in soil moisture content. Interestingly, soil cultivation treatments that were conducted on the same date one year prior showed no improvement in soil moisture or turfgrass quality.

This point validates the thought by many researchers at this time that coring and wetting agents should be used in combination for correcting hydrophobic soils. Soil moisture increases from the wetting agent applications were no longer evident after two years. In 1974, seven wetting agent treatments were added to a new study on the same site. AquaGro and Hydro-Wet treated plots exhibited the highest turfgrass quality ratings of all products tested (Rieke and Bay, 1975). While no phytotoxicity was witnessed during these studies, a follow up study was initiated to determine the phytotoxicity potential of the two best performing products, AquaGro and Hydro-Wet. Both products demonstrated some phytotoxic effects, although these effects were reduced as irrigation increased following application (Rieke and Bay, 1976).

Kaufmann and Jackson (1978) were some of the first researchers to study turfgrass water use rates as affected by wetting agents. This study was conducted on Kentucky bluegrass in-vitro by submerging the plants in solutions of either Hydro-Wet or AquaGro at 0, 200, 1000, or 5000 ppm dilution rates. At four and eight hours following submersion, water use rates were reduced in the wetting agent treated samples by 12-16% depending on treatment. Higher dilution rates did not increase this effect. These researchers conclude that water use rates can be reduced by as much as 10% with the use of wetting agents, but it is unclear whether or not

this is desirable for the turfgrass being grown. Further investigation lead Kauffman (1980) to discover that transpiration is reduced in Kentucky bluegrass plants when the soil is treated with wetting agents or certain fungicides, and this closely resembles the relationship these compounds have on the stomatal conductance tested in this study. Figure 2 is a table from Kauffman's paper showing stomatal conductance, transpiration, and photosynthesis based on chemical treatment. Clearly, while low stomatal conductance reduces transpiration, it also has an effect on CO2 exchange, and therefore reduces photosynthesis. No turfgrass injury was observed in this study, but reducing photosynthesis should not be perceived as a positive attribute.

Table 1. The effect of four turfgrass chemicals on transpiration, photosynthesis and stomatal conductance of Merion Kentucky bluegrass

	(percent of untreated check)		
Chemical	conductance	transpiration	photosynthesis
Aquagro	62	68	87
Hydrowet	28	36	46
Tersan 1991	21	34	31
Chipco 26019	49	58	76
Check	100	100	100

(Figure 2. Reference: Kauffman 1980)

1985 to 1994

Wetting agent use was becoming so common by the mid-1980s that researcher's efforts were focused on finding secondary applications for these tools. Researchers at Cornell University studied annual bluegrass seed head suppression on a golf course fairway with several products, including the plant growth regulators mefluidide and amidochlor, and the wetting agents AquaGro, Hydro-Wet, Basic H, Amway Spray Adjuvant. All products were applied alone and not watered

in. Surprisingly, over a three year period, spring AquaGro treatments reduced seed head production and yield from 26 to 77%; this treatment provided comparable suppression to the mefluidide treatment. Other wetting agents had no influence on seed head formation. Visual quality was slightly reduced with the highest AquaGro treatment from one to two weeks following application, however these effects were not present at three weeks after treatment. Clipping yields were not reduced with AquaGro.

The authors concluded that AquaGro apparently has some growth regulating properties because of the level of seed head suppression in the study, although there was no research to support this at the time (Petrovic et al., 1985). Certainly, timing of application and lack of post-application irrigation play some role here. A similar study was conducted by Cooper et al. (1987) evaluating the effects of mefluidide and AquaGro on root growth, seed head production, and quality of annual bluegrass maintained at fairway height in Ohio. During the peak seed head production time, April to May, mefluidide and AquaGro suppressed seed head density by 76 and 20%, respectively. However, only mefluidide consistently suppressed seed head production throughout the study; it also effectively prevented summer root die back as compared to the control and AquaGro treatment.

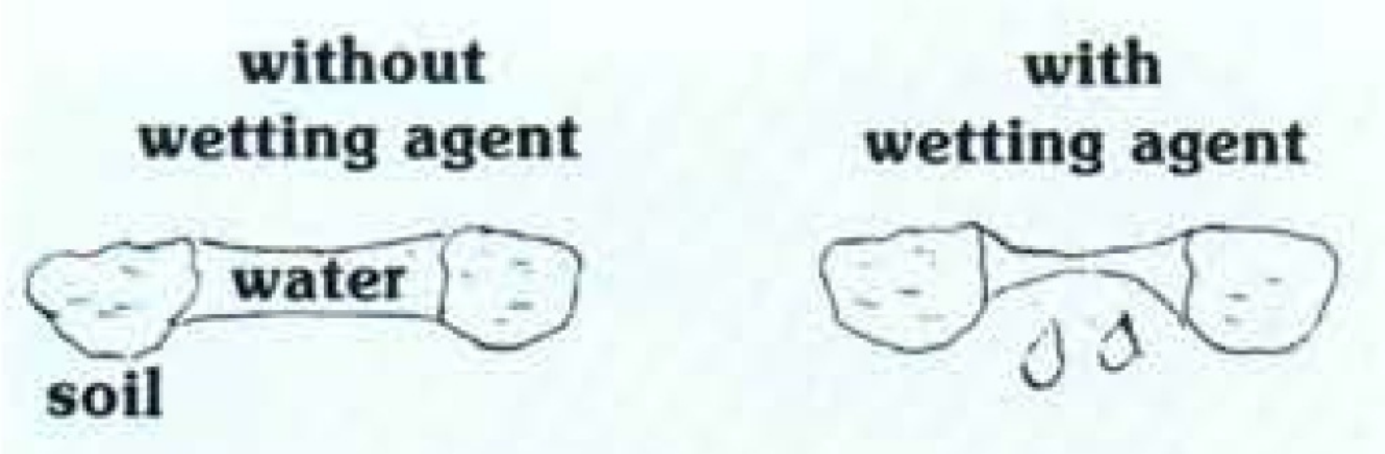
The stimpmeter had become an important tool around this time period. With that, researchers began to evaluate practices that would have an effect on green speed. Langlois (1985) studied the influence of Surf Side wetting agent on the green speed of 'Penneagle' creeping bentgrass in Pennsylvania. Measurements taken for five consecutive days following the wetting agent application showed no significant change in the green speed as measured with a stimpmeter.

Few additional peer-reviewed wetting agent studies were published from 1985-1994, which is surprising. By now, many superintendents and researchers knew the benefits and potential drawbacks that wetting agents had to offer them. Some of the most interesting and informational trade articles being written at this time were from Golf Course Management Magazine (GCM). In a 1985 GCM

article by Bruce Williams (former superintendent at Bob O'Link Golf Club), his success with using wetting agents on fairways to improve moisture distribution and retention was described, citing a 30 percent reduction in total water use since beginning the program six years prior.

Another main benefit Bruce saw from wetting agent use was an elimination of wet areas that were favoring annual bluegrass (Williams, 1985). At a time when wetting agent benefits were primarily defined on hydrophobic soils, Dr. Bob Carrow (1989) discussed how wetting agents could be used to improve hydrophilic (wettable) soils in a GCM article titled "Understanding wetting agents: A look at how they influence soils can help superintendents better predict the results of treatment." Most turfgrass soils are in fact hydrophilic. In these situations, greater drainage could occur with the addition of a wetting agent due to decreased surface tension of the soil water. For this to happen, two factors need to be in place. First, the wetting agent must be present in sufficient quantities in the soil. Second, the soil must be able to drain, meaning no layers or extensive compaction present.

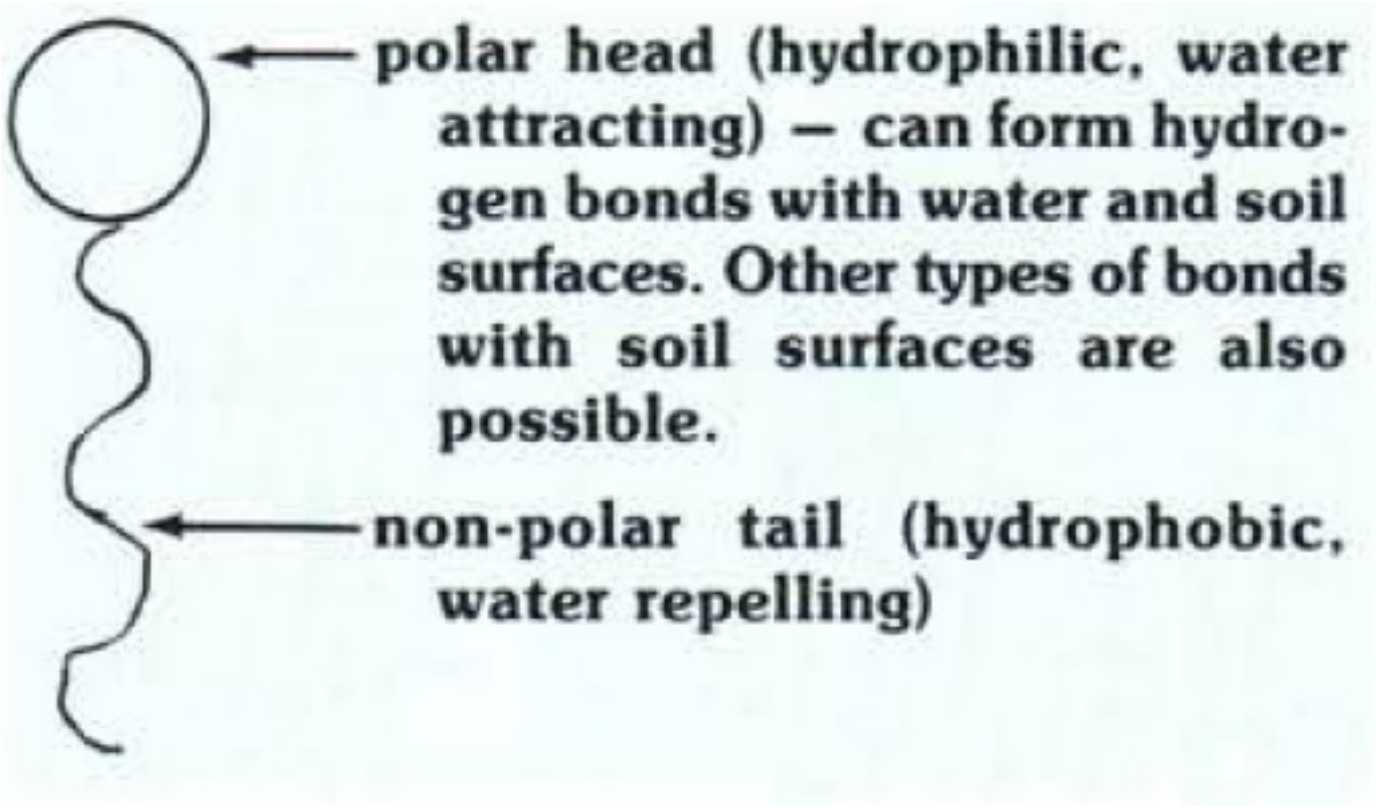
Figure 3 is a diagram of wetting agent interaction on hydrophilic soils from Dr.



(Figure 3. Reference: Carrow 1989)

Carrow's article. In addition to describing the wetting agents in hydrophilic situations, Dr. Carrow also discussed the mode of action of most wetting agents and how they behaved when in contact with hydrophobic soils. Non-ionic wetting

agents have a polar (hydrophilic) head and a non-polar (hydrophobic) tail (Figure 4). As you would imagine, the tail attaches itself to the soil and the head attaches to



water, holding water in place for plant uptake.

(Figure 4. Reference: Carrow 1989)

Quinn (1993) described in a GCM article the "Special applications for wetting agents"; ranging from seed head reduction to overall water savings, however, much of this was still up for debate. At this time there were several proven products that were able to back up their claim of improving soil wettability or making "wetter water." Those products included: AquaGro (Aquatrols), Aqua-Aid (Aqua-Aid), Hydraflo (Grace-Sierra), Hydro-Wet (Kalo), Surf Side (Montco Products), Naiad (Naiad Co), Paragon (Precision Labs), and NOBURN (ROOTS).

Quinn also mentioned superintendent's successes injecting wetting agent through Toro's water aerator, the HydroJect. This process had been approved by the Toro Co. one year prior (Phillips, 1992). It was also in 1993 that the International Turfgrass Society Research Journal published a method for an individual to determine initial and residual effects of the wetting agents that they were using. The simple procedure involved filling a clear drinking straw with hydrophobic soil and measuring infiltration rates with different wetting agent concentrations (Mane, 1993). Even today, this simple procedure could be useful for a superintendent trying to justify the cost of wetting agents to his greens committee or membership.

1995 to 2004

By 1995, wetting agents were no longer considered out of the norm of basic agronomics, but research results were inconsistent and it was hard to identify the benefits that products could consistently produce on individual properties. In a study looking at three different wetting agents and their influence on alleviating soil water repellency of a 'Tifdwarf' bermudagrass stand, Cisar et al (1997) found that applications of Primer or Aqueduct provided significantly better turfgrass quality and reduced localized dry spot as compared to AquaGro and an untreated control. Combination treatments of Primer/Aqueduct or Primer/AquaGro did not provide higher turf quality ratings or fewer localized dry spots than the treatments applied alone. Also studying Primer, a researcher in Massachusetts evaluated the amelioration of water repellency on 100 percent sand-based creeping bentgrass tees using two rates of Primer (125ml and 185ml per 100m2) compared to an untreated control. After two applications, turfgrass quality improved, and localized dry spots and afternoon wilting were nearly eliminated. Kostka (2000) cited four benefits of the Primer application: 1) reduced soil water repellency, 2) enhanced turfgrass performance, 3) improved uniformity of turf, 4) increased available soil moisture. At Michigan State, researchers studied the effects of Primer and Midorich wetting agents on water retention and distribution in sand and loamy sand with no turf cover. While not significant, Midorich increased the water retention in the upper two inches of the sand system, whereas Primer significantly increased retention at six and ten inches. This data suggests that these two wetting agents react differently

in the soil, specifically Midorich remains in the upper profile and Primer moves more rapidly to greater depths. Trends were similar in the loamy sand root zone (Leinauer et al., 2001).

Karnok and Tucker (2001) evaluated the color, quality, and root growth effects of the wetting agent Tilwa applied to 'Penncross' creeping bentgrass grown on hydrophobic soil. Only a single application of wetting agent was made. Ratings were taken up to 18 weeks after treatment and the single wetting agent application improved turfgrass color and quality 78 percent of the time. Overall root length at the 0 to 8 cm was increased by 27 percent with the wetting agent application; this and the increase in turf quality can be attributed to the six percent increase in volumetric water content (VWC) of the hydrophobic soil over the duration of the study. Consider that field capacity of a sand-based system is 10-15 percent; an increase in six percent VWC can have profound effects on the turf plant.

At this time we still questioned the effectiveness of wetting agents in reducing seed head production of annual bluegrass. Researchers from the Chicago District Golf Association studied the effectiveness of AquaGro, as well as a newer wetting agent, Cascade, at inhibiting seed head production compared to several standard plant growth regulators. After three years, mefluidide and ethephon provided the most consistent suppression of annual bluegrass seed heads on putting green and fairway turf; suppression reached 95 percent, but phytotoxicity was concerning. While inconsistent, the wetting agent treatments provided up to 50 percent suppression of seed heads (Kane and Miller, 2003).

In addition to alleviating localized dry spot, wetting agents have been evaluated for their effectiveness at controlling fairy ring, a basidiomycete fungi implicated at causing soil hydrophobicity. Gelernter and Stowell (1997, 1998) evaluated the wetting agents Primer (alone) or Respond (alone or combined with azoxystrobin or flutolanil). Both Respond and Primer were effective at reducing localized dry spot (type C fairy ring), but not at reducing type B fairy ring which is a more progressed form of the fungus. The fungicides azoxystrobin and flutolanil were most effective at suppressing the symptoms of type B fairy ring when

Respond or Primer were added. Based on these studies, Gelernter and Stowell (1999) developed new management approaches for both fairy ring and localized dry spot. These approaches included five basic steps: 1) maintain thatch thickness below ½ inch, 2) use wetting agents to alleviate localized dry spot, 3) use fungicides flutolanil or azoxystrobin to control associated fungi, 4) implement a spring cultivation program, 5) hand water hydrophobic soils thoroughly. In a similar study aiming to control localized dry spot symptoms with flutolanil and wetting agents, Karnok and Tucker (2001) demonstrated that flutolanil alone, while effective in preventing localized dry spot, will not control the symptoms once they have developed. Wetting agents are required to cure the hydrophobicity of the soil.

2005 to present

The most comprehensive research on wetting agent use was completed in 2005 by the Golf Course Superintendent's Association of America and the United States Golf Association. A total of nine sites across the United States were chosen to conduct this research on ten commercially available and popular wetting agents. Research objectives included an evaluation of five characteristics: 1) turfgrass phytotoxicity, 2) turfgrass color and quality responses, 3) impact on soil hydrophobicity, 4) dew formation, and 5) pest damage. All wetting agent treatments were applied per label instructions according to the highest rate recommended to cure hydrophobic soils. This study was conducted for four months in 2003 and 2004 corresponding to the peak stress period at each location. Figure 5 shows a table with all wetting agents and application rates and timings. Results varied based on region, turfgrass species, and degree of soil hydrophobicity. In Michigan, turfgrass quality ratings were consistent among treatments from 2003 to 2004, and all wetting agents tested (except for Naiad) significantly improved turfgrass quality over the control. This is not consistent with the turfgrass color ratings seen in Missouri, where Cascade Plus produced the lowest color ratings in 2003; there was no statistical color difference between these treatments in 2004. The water droplet penetration test (WDPT) was used at each location to determine wetting agent effects on soil hydrophobicity. This test involves removing ¾ inch cores from each plot, placing a droplet of distilled water at various depths

on each core, and determining the time that it takes for each droplet to penetrate the core. Surprisingly, in Missouri the wetting agents that were most effective in curing hydrophobicity also reduced turfgrass color; this contradicts Michigan data. It appears that the Missouri sand rootzone was drastically less hydrophobic (WDPT = 18 seconds) than the sands in Michigan (WDPT = 322 to 340 seconds). This implies that the Missouri plots had less to benefit from the wetting agent applications. In Michigan, WDPT closely reflected turfgrass quality; Naiad and control plots had the longest time for water penetration and also the lowest turfgrass quality ratings. Observations from these two states indicate that the wetting agents Aquaduct, Brilliance, Cascade Plus, Hydro-Wet, LescoFlo, Primer Select, and TriCure all have the ability to reduce soil hydrophobicity, but produce inconsistent results in turfgrass color and quality (Throssell, 2005). For a detailed explanation regarding questions about this research, visit Karnok (2005). It's important to note that newer wetting agent chemistries have been released since this study, such as Aquatrols Revolution (Pioppi, 2005).

WETTING AGENTS AND RATES

Product/rate (ounces)*	Timing	Spray volume (gallons/1,000 sq. ft.)†	Watering in
Aqueduct			
8	first application	1	irrigate before next mowing
8	1 week after first application	1	irrigate before next mowing
8	once every four weeks after second application	1	irrigate before next mowing
Brilliance			
8	first application	2	immediately after application
8	10 days after first application	2	immediately after application
8	12 weeks after second application	2	immediately after application
Cascade Plus			
8	first application	2	immediately after application
8	10 days after first application	2	immediately after application
Hydro-Wet			
8	first application	10	immediately after application
8	two weeks after first application	10	immediately after application
2	every two weeks after second application	5	immediately after application
LescoFlo			
8	first application	10	immediately water in
8	two weeks after first application	10	immediately water in
Naiad			
8	first application	10	immediately after application
8	two weeks after first application	10	immediately after application
6	once every four weeks after second application	10	immediately after application
Primer Select			
6	first application	2	irrigate before next mowing
6	every four weeks following first application	2	irrigate before next mowing
Respond 2			
10	first application	8	immediately after application
10	8 weeks after first application	8	immediately after application
Surfside 37			
32	first application	10	immediately after application
4	every two weeks after first application	10	immediately after application
TriCure			
6	first application	2	immediately water in
6	every four weeks following first application	2	immediately water in

*2, 4, 6, 8, 10 and 32 ounces = 59.1 milliliters, 0.12 liter, 0.17 liter, 0.24 liter, 0.30 liter and 0.94 liter, respectively.
†1, 2, 5, 8, and 10 gallons/1,000 square feet = 40.7, 81.5, 203.7, 326 and 407.5 liters/1,000 square meters, respectively.

Table 1. Wetting agents, rates of application in fluid ounces, timing of application, spray volume and post-application watering instructions used in the GCSAA/USGA wetting agent evaluation. The first application of all wetting agents was made on the same date and before the appearance of any symptoms of localized dry spots.

(Figure 5. Left. Reference: Throssell, 2005)

More regional specific studies have been conducted in recent years by the University of Minnesota-Twin Cities and the University of Wisconsin-Madison. These studies have been published in Hole Notes and The Grass Roots. One study included in the June 2011 issue of Hole Notes, "2010 Wetting Agent Study Update", evaluated the effects of six wetting agents that were currently being used by twelve golf courses in Minnesota.

Through GPS mapping of TDR data, these researchers were able to track changes in soil moisture levels and uniformity following a wetting agent application. In this study, block polymer and modified block polymer wetting agents (TriCure, Revolution) increased soil moisture and uniformity distribution by an average of 4.7 and 4.8 percent, respectively. Gluco ether block polymer wetting agents (Tournament Ready, Dispatch) reduced soil moisture by 2.7 percent, while decreasing uniformity by 3.9 percent. This study is a good demonstration of the differences between the water-holding and soil-penetrating chemistries of wetting agents (Johnsen and Horgan, 2011).

A follow up study was conducted in 2011 on the same golf courses with a modified treatment list. Wetting agent chemistry differences continued to be apparent based on soil moisture and uniformity. TriCure, Revolution, Immerse GT, Magnus, and Performa Gold treatments increased soil moisture by an average of 4.4 percent. Dispatch decreased soil moisture by 4.7 percent. TriCure, Magnus, and Revolution increased uniformity by 6.5 percent, while Dispatch and Tournament Ready reduced uniformity by 4.5 percent (Johnsen et al., 2012). These results are fairly consistent with the data collected in 2010. For a detailed explanation of the various wetting agent chemistries, read the article published by Zontek and Kostka (2012). Karnok published a recent article in GCM (2013) and laments the difficulties of understanding the chemistry of wetting agents and states: "who cares about the chemistry".

Dr. Doug Soldat addressed the question of how wetting agents perform in wet (or hydrophilic) soils in a two-year study conducted in Madison, Wisconsin. Six wetting agents were evaluated for their ability to reduce VWC in high moisture conditions on a one-year-old 'Penn A4' creeping bentgrass USGA spec putting green. During the 2009 study year, all wetting agent treatments had consistently lower VWC levels than the untreated control, with Revolution reducing VWC the most (> 4 %). Treatments of Tournament Ready, Sixteen90, and two experimental products from Aquatrols all demonstrated similar VWC values, which were consistently 2 percent drier than the control. Revolution was tested alone in 2010 and resulted in a less dramatic reduction in VWC compared to the control on the same putting green. Moving the treatments to an eight-year-old putting green with approximately 4 percent organic matter resulted in little VWC statistical difference between Revolution and the control (Soldat, 2010).

This data further validates that the benefits of wetting agents differ by soils; that these wetting agents have the ability to improve the wetting of hydrophobic soils and will reduce soil moisture in wet conditions. Soldat et al. (2010) also evaluated wetting agent effects on localized dry spot development, turfgrass quality, moisture uniformity, and moisture content on a 'Penncross' creeping bentgrass green. Two control plots (replacement of 100 or 30 percent evapotranspiration, ET) were compared with the wetting agents Aquaduct, Primer 604, and Revolution water at a replacement 30 percent of ET. Control plots irrigated with 100 percent replacement of ET demonstrated the highest turfgrass quality and least amount of localized dry spot, whereas the 30 percent ET control plots were below acceptable levels for most of the study. All wetting agent treatments provided acceptable turfgrass quality for most of the study with only 30 percent ET replacement. Soil moisture uniformity was the highest in all wetting agent treatments. Soil moisture content in wetting agent plots reflected changes in weather patterns; wetting agents improved the moisture content under dry conditions and reduced the moisture content under wet conditions. Remember this was reinforced by Carrow (1989).

Conclusion

The breadth of information presented throughout this review demonstrates where our knowledge has originated related to wetting agents. Much like winter injury studies in turfgrass, wetting agent research can vary greatly by location, soil type, irrigation practices, species, product, season, etc. There are no clear cut recommendations on how to effectively utilize wetting agents at your property. Please use the research cited in this article in conjunction with your local knowledge and experience. We've all read the purported benefits of the so-called wetting agent that will cure every problem under the sun. But we've also acknowledged the fact that a single wetting agent can both increase VWC and decrease VWC of a rootzone, improving uniformity. These products are tools that, when used wisely, can make a nice complement to your turfgrass management arsenal.

Opportunities for future research on wetting agents might involve their impact on surface firmness or winter survivability. We anticipate this information to be available in the years to come. For more background on wetting agent basics, we suggest reading the highlighted articles in the references section.

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Sam Bauer has provided links to many of these articles for your review. They can be opened at http://www.mgcsa.org/resources/research/troe-center-updates/

On Board

Q&A with Members of the Board of Directors

If you were given one week off in the dead middle of the season to leave and do anything you wanted what would it be?

E. Paul Eckholm, CGCS, Affiliate Member
with Yamaha Golf and Utility

My personal choice for a week break is to go somewhere there is sun and a beach with moderate temps. In other words, I would love to have a week in Maui, Hawaii. Although I hate the travel to get there, a week of total relaxation and decompression would be welcome any time of the year.

Jake Schmitz
Superintendent Olympic Hills Country Club

I would be on Little Long Lake north of Grand Rapids, with my wife and kids, spending a lazy week at a cabin. Boating, fishing, biking and hanging out by the campfire at night. Some way or another, I am going to make that happen one of these years, even though I am a golf course superintendent.

Pristine Prestwick: A Championship Ven

If you visited the quiet little town of Woodbury, Minnesota 30 years ago you probably would never have guessed that it would become the very definition of suburbia. With no downtown and acres upon acres of farmland, it was the definition of rural. What a difference 30 years makes. Woodbury has grown from a tiny blip on the edge of St. Paul to a 70,000 person super-suburb, and perhaps the heart of its growth is the Wedgwood Sub-division and its crown jewel the Prestwick Golf Club- host to the 2013 MGCSA Championship.

In its infancy, Prestwick was known as Wedgewood Valley Golf Club. The original idea of the golf course came from a man named Norb Anderson. It was Anderson who dreamed and executed the process of procuring a golf course in Woodbury. However, the ball really got rolling when the Minnesota Mutual insurance company purchased the project and designed Minnesota's first planned golf course/residential community. That plan would become the standard across the metro area in the decades to come.

Wedgewood opened in 1985 and was designed by a host of contributing architects but the main layout was by Anderson. It opened as a public golf course that provided unlimited play memberships and remains a public course to this day. It regularly hosts outside tournaments while

Photo credit Dave Kazmierczak, CGCS

preserving a country club feel for its regular play customers. The high water mark for rounds was 42,000 in 1998 but has leveled off to between 32,000 and 36,000- the total for last year.

In 1996 the golf course and clubhouse were sold to John and David Mooty, who partnered until David eventually became sole owner in 2000. The name of the course was changed to Prestwick at the request of the seller, and reflects the Mooty's desire to link the course to the heritage of golf (Prestwick in Scotland is considered the second oldest course in existence) as well as the Mooty's Scottish ancestry.

Mooty has been the sole owner since 2000, and has shown his commitment to the course and the community by making solid changes to the course itself and by installing a full service restaurant in the clubhouse in 2005. Doubling the clubhouse, Mooty partnered with the Axel's chain of restaurants and opened Axel's at Pretwick in July of that year. In 2012 the Axel's people were bought out and the name changed to David's Chophouse, the restaurant that exists today.

While the initial layout between the large lots of Wedgewood was great for selling homes and protecting real estate property from errant shots, it left a little to be desired for playability from a golfer's prospective. For that reason Mooty hired Kurt Sandness from Sandness Design Group to devise a long term renovation plan for Prestwick in 2001. Under the direction from Sandness, Mooty and even the course Superintendent, Don Slegers and Park Construction undertook the task of changing the golf course into what it is today.

The major emphasis of the renovation was the bunkering. The total number of bunkers only changed from 67 to 76 but the positioning and location of them was a dramatic change. Holes number four and eighteen, both par fives, changed from linear, boring straight holes to strong par fives with shot placement critical to avoid bunkering designed to capture a missed shot on either side of the fairway.

Drainage was placed in every new

The Prestwick "A" Team,* *photo by Steve Sandberg

bunker along with a bunker liner in attempt to remedy the problem of bath tubs and contamination that was plaguing the old design.

Along with the bunkering, many tees were added or expanded to meet the demands of more and more rounds, and three of the greens; numbers seven, nine, and 13 were also re-shaped back to their original design that was abandoned for a more circular style of green.

Renovation was started in 2002 with holes two, three and nine and continued each year until 2009 when the economy worldwide and in golf in particular took a nose dive. Holes one, ten and 17 are still left on the renovation list.

But before any renovation was to take place, what Prestwick really needed was a new irrigation system. The old original block system was 16 years old in 2001 and in very bad shape. It was unable to meet the demands of higher turf quality and Mooty decided to pull the trigger on an $850,000 tip-to-tip Toro and Flowtronix system comprising of 1,025 large sprinkler heads and roughly another 500 small heads to provide precision irrigation for the next quarter century.

It was a very hard, but very wise decision. That same system today would more than likely cost near double that price and continues to service the playing public at Prestwick at a high level. The system has grown since then, with the addition of another 175 heads to provide optimal

coverage.

The lineage of caretakers at Prestwick is a short list. Dennis Hendrickson served as the original superintendent from grow-in until 1994. He was there from the beginning and recalled Anderson literally telling him to go throw a stake in the ground, and that was going to be the first green, tee, etc. Hendrickson was succeeded by Jerry Webb, CGCS in 1994. In 2001, Dave Kazmierczak, CGCS became the third Superintendent and remains to this day.

Though the course has seen many recent changes, the people behind the scenes have been constant. Along with Kazmierczak's 13 years at the helm, Chad Braun, Equipment Manager and Building Supervisor is in his 17th year. Dick Reig, Horticultural Manager is serving his 19th year as Lord of the annuals and perennials. Second Assistant Alejanrdo Leon has eight summers of experience under his belt. While he does not have Prestwick experience, first assistant Adam Lesmeister provides veteran leadership from years on the golf course. Even the Head Golf Professional, Tom Wahl, is in his 16th year at Prestwick. Many of the other part-time operators are at or past a decade of service. Together, they are the backbone of a team effort that makes Prestwick a high quality, beautiful course that challenges players of all skill levels.

Hole 17, par 3 from the back tee. It could be your ace! ***Photo by Chad Braun.***

Looking back onto the third hole. A pretty shot by Dave Kazmierczak, CGCS.

Propane Offers A Promising

Content and photo contributions Mark Linkletter, Ferrellgas

Golf Course maintenance crews can now power their mowers using a fuel that's as green as the grass they're cutting.

That fuel is propane, a product that's been powering gas-burning appliances at rural homes, farms, and businesses for decades. Found in both crude oil and natural gas, propane burns cleanly, especially when compared to gasoline and diesel fuel. In fact, propane, which is approved under the Energy Policy Act of 1992 for use by federal and state fleets as an alternative fuel, has an octane rating of 104 to 107 and allows for a higher compression ratio, enabling a propane engine to run just as powerfully and more efficiently than with gasoline, which has an octane ratio between 87 and 93. As a result, propane-fueled vehicles can meet the very tough Ultra-Low Emission Vehicle (ULEV) standards.

Lower emission costs

Alternative Part I

Propane's higher octane level, higher compression ratios, and closed systems, while being environmentally friendly, have another benefit—they lower maintenance costs.

Tests have shown that oil, oil filters, spark plugs, carburetors, and engines in propane-powered equipment last up to three times longer than gasoline-powered equivalents, and that during the lifespan of that equipment, fewer tune-ups are required. At present, new propane mowers can be slightly more expensive than traditional gasoline equipment, but lower fuel and maintenance costs over the lifetime of the equipment more than balance the equation.

Lower fuel costs

For most grounds maintenance applications, propane is either delivered and stored in bulk tanks on site or delivered in ready-to-mount mower cylinders that are re-filled by the supplier after use. Either way,

there is a significant cost savings over gasoline. Overall, the price of propane compares favorably with the price of conventional or reformulated gasoline, historically running at under (75%) of retail costs. Many states offer fuel tax incentives or alternative fuel benefits to encourage the use of propane, helping to further increase fuel savings.

Another center of expense—fuel shrinkage—is virtually eliminated in a transition to propane. Propane is, at present, not a common fuel for cars and trucks and is less vulnerable to theft in the field and on site. Also, because of propane's closed storage and delivery systems, fuel budget losses due to loss, evaporation, spillage, and theft, as well as contamination from rain, dirt, and other contaminates, are essentially eliminated.

Environmental benefits

A number of states across the union are either eyeing or actively pursuing legislation to cut the emissions of mower fleets owned by the state or its institutions. This, coupled with heightened senses of environmental and fiscal awareness at every level of business and education, bring new attention to clean-burning and economical propane as a fuel.

It is well known that gasoline engines on grounds maintenance equipment, in particular, emit high levels of carbon monoxide, volatile organic compounds, and nitrogen oxides. Those engines produce, on average, 5% of the nation's air pollution, a number that can be significantly higher in metropolitan

areas. Emissions are so low that propane mowers can be used during "Ozone Action Days"—days deemed by cities or states as especially likely to foster the production of ozone—when the use of gasoline-powered engines is either prohibited or discouraged.

Propane-fueled equipment has minimal emissions. Studies indicate that smog-forming hydrocarbons are lowered 60% to 70% in propane-fueled engines vs. gasoline, along with 12% less carbon dioxide, 20% less nitrous oxide, and 60% less carbon monoxide. Toxins and carcinogens such as benzene and toluene are eliminated almost entirely as well, seeing 96% reduction in their level.

Gasoline, in addition to being a heavy post-burn pollutant, is a spillage and evaporation hazard. While propane is a gas in its uncompressed state, it is stored as a liquid. "Closed" storage and delivery systems, meaning airtight systems that keep propane in its compressed, liquid state, prevent leaking and evaporative emissions by their nature—effectively removing spillage hazards from your environment. Should a leak develop in the system, propane escapes. As a non-toxic gas, the environmental impact is minimal.

Propane tanks are also safer to have at your facility, having been rated at up to 20 times more puncture-resistant than gasoline tanks. On the whole, propane is a safer, more environmentally sound option than conventional or reformulated gasoline. Propane

Photo credit Chris Carpenter, UofM

has been referred to for years as an alternative fuel, but when it comes to powering mowers, there may be no better alternative.

Mark Linkletter is Mower Fuels Sales Manager for Ferrellgas, a nationwide propane company headquartered in Overland Park, Kansas. Find out more at www.ferrellgas.com and www.ferrellautogas.com.

Within the Leather

by David Kazmierczak, CGCS

Science, research and invention are funny things. People spend entire careers, heck sometimes their whole lives trying to prove a theory or invent the next great thing. Some are successful, some are not. The ones who are successful become rich, famous or at least get a pat on the back from somebody. The ones who are not, well, thanks for trying.

Which is kind of tragic in a way, because there are a lot of those people who have painstakingly tried throughout history to better mankind through science and invention only to come up with nothing.

Compounding that notion of tragedy, are the people who got "lucky". These are men and women who stumbled upon ground-breaking revelations by accident or by failure. There are many of these kinds of accidental products we know and use on an everyday basis.

Post-it notes are one of these. The 3-M corporation was working on a super-strong glue that would virtually never break. What they came up with in early trials was virtually the weakest glue ever known to man. The only thing that it would hold together was two pieces of paper. Bingo. I will go out on a limb and say there is nobody reading this that has never used a post-it note.

Another example is Viagra. The scientists that came up with Viagra invented it with the sole purpose of helping cure arterial blockage and increase blood flow in older males. It increased blood flow alright. When the test subjects came back and reported their, um, findings it didn't take long before Viagra turned into a gold mine that kept old men and stockholders alike smiling.

Why am I bringing all this up you may ask? Well, we all have the ability to be closet researchers and scientists. All you have to do is open your eyes. Trials and tests of every theory known to man and every conceivable invention occur on a routine basis in your very environment, especially on the golf course. If you open your eyes, you might discover something new.

Such was the case for me on Sunday July 14. But before I share what I saw on that day, let me give you some background on why what I saw that day was so interesting.

About five years ago I started noticing that we would have these very long, fast growing what looked like leaf blades on a couple of our putting greens. It would last a few days and was very sporadic, yet by the end of the day they were noticeably higher than the rest of the canopy. It lasted about five days to a week and then seemed to subside.

The next season it occurred again, and I thought it was very strange so I had a couple samples sent off for analysis and asked around if anybody had experienced anything similar. The results from the samples were fairly inconclusive and ranged from a growth regulation issue to possibly a viral or bacterial problem. I found out that indeed others had experienced a similar thing with the same inconclusiveness.

A couple more years passed and then I read an article about etiolation of bentgrass and some theories as to why this phenomenon was occurring. For some it has become quite problematic. This article stated that they thought it was clearly due to a bacterial issue. I do not recall the exact reasoning or research behind it, and the etiolation could possibly be different from what I experienced. Who knows? I hadn't seen the problem since at least three years ago and it had long slipped from the top of my concerns list.

Until last Sunday.

There in front of me on hole number 13 at Prestwick was science, research, chance, an accident and an enigma all rolled into one.

Photo credit Dave Kazmierczak, CGCS

On July 2nd, roughly two weeks before my casual observance, one of my assistants was given the task of spraying fairways with an application of 4oz/M Interface and 5 oz./ acre of Primo. It was a task he completed successfully and without incident except for one minor issue. He somehow dislodged a nozzle from its rightful place, creating a wonderful green stripe down the length of the fairway until he noticed his indiscretion and corrected it, then informed me.

I figured it would fade away over time and did not give it much thought until Sunday the 14th when I observed etiolation in the volunteer bent and in the start of our bentgrass approach where he had started the application, and only in the over-sprayed area.

Wow! I thought to myself. This pretty much confirmed my suspicion a few years back that it was a growth regulator issue, or a combination of the regulator and the fungicide on my variety of bentgrass (Penncross). My inner scientist and researcher were all abuzz thinking of the timing and conditions of the course both during the past experiences and the most recent one. My conclusion was that if you spray too much Primo on Penncross, it's going to cause it to do goofy things. Not exactly an earth shattering revelation, but it was at least enough to keep me amused for the rest of the morning, and gave me something of relevance for this column, which lately has seemed to border on completely irrelevant.

So now I am sharing this most accidental of findings with our little corner of the turf world. Take it for what it is worth, but realize that everything that occurs on your course both good and bad has a story and maybe has the potential to impact others over time. Share thoughts, ideas and experiences with your peers and who knows? That inner scientist or researcher in you, like the Viagra guys, might lead to much bigger and better things!