mat accumulation. These symptoms were often mistaken for localized dry spot by people not familiar with the study. Turfgrass quality rapidly improved as STP level increased from 3 ppm, the P level of unfertilized sand, to the critical point which averaged 7 ppm. The exact critical point for each month varied from 6 to 11 ppm. Turfgrass visual quality did not change once Mehlich-3 STP values exceeded the critical STP point. There was not a clear trend relating critical point to season despite reports of reduced P uptake in spring and fall due to cold soil temperatures. Other factors, such as clipping yield, were used to calculate Mehlich-3 critical points but the critical point was not as obvious with those calibrations and turfgrass is fertilized to sustain visual quality not maximize clipping yield.

We hypothesized Primo would reduce the STP critical point because it would reduce leaf demand for P and reduce P loss during mowing. However, Primo MaxxTM did not change the STP critical point by a practically significant level. This is partially because the STP critical point is so incredibly low without Primo. Turfgrass visual quality was enhanced with 200-GDD Primo applications only once the STP level exceeded the critical point.

Mehlich-3 STP critical point for the green in this study was 7 ppm, the exact STP requirement for other creeping bentgrass putting greens is likely different. Factors such as soil mineralogy and pH, grass cultivar, environmental conditions (i.e. shade), and N fertilization rate can alter the STP critical point. For example, Dr. Kussow has demonstrated that plant demand for P increases as N rate increases growth rate (Kussow and Houlihan, 2006). Despite these factors, Mehlich-3 STP levels of 15 or greater likely satisfies most sand-based bentgrass putting greens of Wisconsin.

Another important factor affecting the critical point is depth of soil sampling. Plant roots re-distribute nutrients toward the top of the root zone. As a result, shallow sampling will lead to higher soil test values than deeper sampling. In June 2010 a cup cutter was used to pull a five inch deep plug for an area outside of the research plots. The plug was then sectioned into five one inch thick samples and sent to UW-SPAL for nutrient analysis. Nutrient levels declined further down the profile. A one inch deep soil core from this plug would have soil test phosphorous and potassium values of 16 and 94 ppm, respectively. A five each deep sample from the same plug would have P and K soil test values of 9 and 34 ppm, respectively. This result shows the importance of consistent sampling depth. These differences will likely become larger as the green continues to age. Soil sampling in this study was conducted at a depth of 3 inches.

Figure 1. Various amounts of monopotassium phosphate fertilizer were incorporated into 32 plots during construction of the putting green with a rototiller. This method resulted in a broad range of Mehlich-3 soil test phosphorus levels and turfgrass deficiency symptoms.

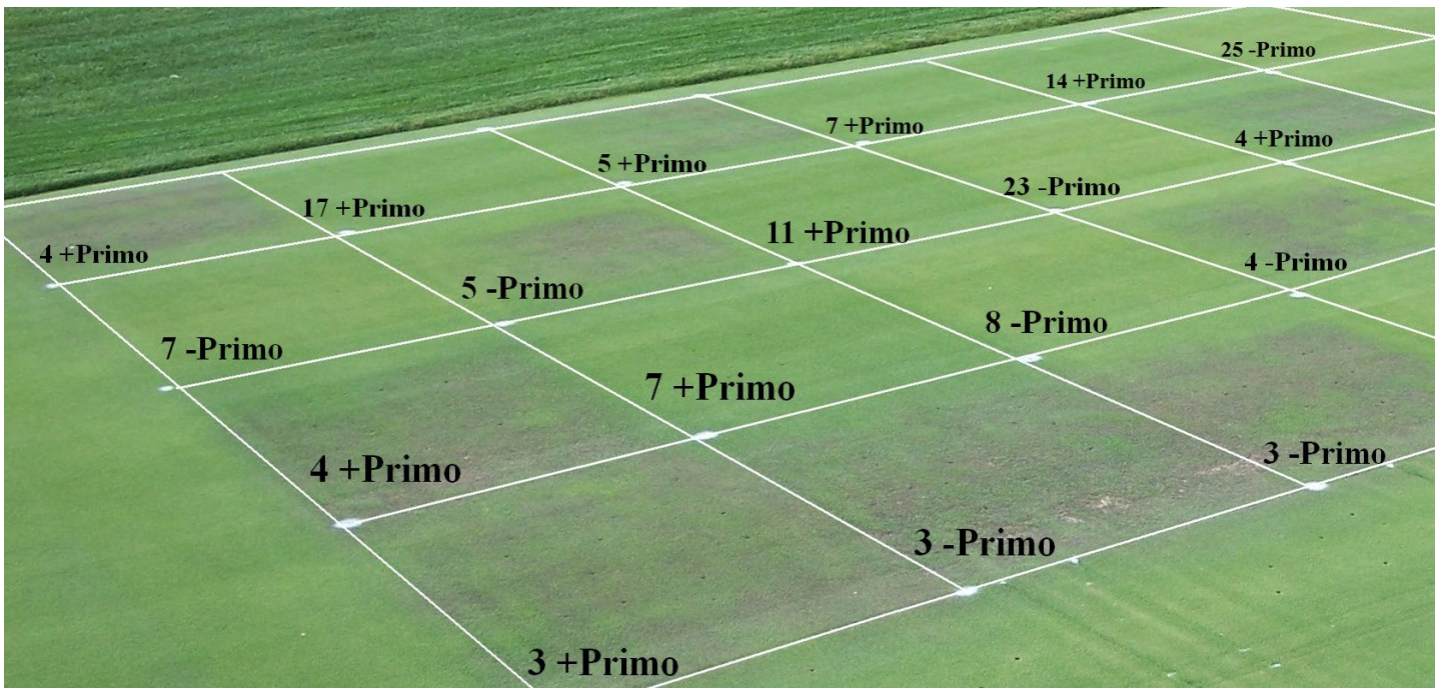

Figure 2. A broad range of Mehlich-3 soil test phosphorus levels (STP) and turfgrass deficiency symptoms was created. The effect of Primo MaxxTM on STP critical point and STP decline was also assessed. Numbers represent Mehlich-3 STP values (ppm) for each plot with or without Primo MaxxTM. Soil test values below the critical point of 7 ppm displayed obvious P deficiency symptoms. After STP level exceeded the critical point of 7 deficiency symptoms disappeared and Primo MaxxTM increased turfgrass quality relative to the non-treated.

The Decline of Available Soil P

Soil test phosphorus levels decline primarily for two reasons under a dense stand of turfgrass. Phosphorus removal during mowing is a process directly under the control of the turfgrass manager. Simply returning clippings can substantially reduce nutrient removal. This is usually impractical on golf putting greens where clippings can disrupt playability and aesthetics. Plant growth regulator applications, on the other hand, can suppression clipping yield and subsequent nutrient removal. Primo MaxxTM applications during this study reduced P removal by an estimated 32% or approximately 0.8 lbs. P/M during the 18 months of this study.

The other process of STP decline is soil P fixation. The rate of fixation depends on many factors including soil mineralogy and pH. The sand used to construct this putting green had and initial pH of 8.8. That pH value suggests the sand was buffered by calcium carbonate, typical of many sands of the upper Midwest, and some amount of exchangeable sodium. This is an ideal soil condition for rapid P fixation. During the 18 months of this study, the STP levels of all plots decline to the level of the unfertilized sand (3 ppm). Plots with a high initial STP values declined most rapidly. For example, one plot had an initial STP value of 55 ppm declined to 28 ppm after one month. At the end of the study the STP value of that plot was 11 ppm, a change of 44 ppm in 18 months.

It could be easy to confuse P deficiency symptoms with localized dry spots. If Turfgrass isn't responding to irrigation, try adding a small amount of P fertilizer to the area

Although Primo reduced P removal from mowing, STP levels declined at the same rate regardless of Primo treatment because rapid soil P fixation overshadowed P removal from mowing. The average pH value of this putting green declined from 8.8 at construction to 6.7 at the end of the study. Therefore, it is likely as the green continued to age and chemical properties change P fixation would slow and plant growth regulators may been more effective at sustaining STP level. This also has implications for soil testing frequency. Soil testing of new putting greens should be done annually for the first five years, at which point testing every two to three years is probably sufficient.

Treating Phosphorus Deficiencies

It could be easy to confuse P deficiency symptoms with localized dry spots. If turfgrass isn't responding to irrigation, try adding a small amount of P fertilizer to the area. Even the slightest amount of P fertilizer application can quickly improve turfgrass quality. During establishment of this study, maintenance applications of liquid P fertilizer were applied to select plots to combat rapid P immobilization. A leaky spray nozzle dripped a very small quantity of P fertilizer onto plots that had not received P fertilization. Within a few days, a "river" of green turf could be seen cutting through the otherwise P deficient plot (Figure 4). The green "river" persisted for months even though the amount of P applied was miniscule.

Finally, at the end of the study all plots were treated a liquid application of monopotassium phosphate. After three weeks all plots that were P deficient for the past three years, and some thought dead, had completely recovered (Figure 5). The color, visual quality,

and growth rate was actually greater than the plots were never P deficient. This is a prime example of the 'Law of the Minimum.' Plant growth is always controlled by the most limiting nutrient. A vast majority of the time that is nitrogen. However, when P is deficient N is no longer the most limiting nutrient and accumulates in the soil. Plots that were not limited by P utilized all available nitrogen. Phosphorus was no longer the most limiting nutrient after P was applied. Then, the accumulated nitrogen underneath plots that were P deficient was available for use by the turf and caused the greater growth and darker color.

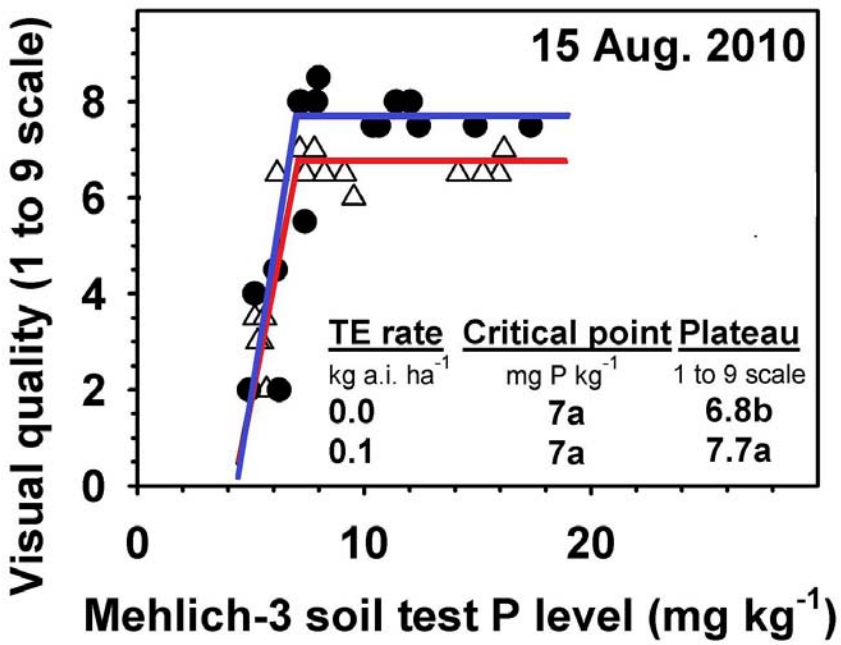

Figure 3. Turfgrass visual quality rating clearly indicated the Mehlich-3 soil test phosphorus (STP) critical point for each month. This rating day is representative of the 12 rating days during the 2009 and 2010 growing season. Visual quality rapidly increased until the STP level exceeded the critical point. After STP level was greater than the critical point only Primo Maxx applied every 200-GDD further enhanced quality.

Conclusions

- The Mehlich-3 STP critical point for this putting green averaged 7 ppm, other factors such as N fertility, grass species, soil chemistry, and the growing environment will affect the critical point for other putting greens.
- Generally, Mehlich-3 soil test phosphorus (STP) requirement for sand-based creeping bentgrass putting greens is likely not greater than 15 ppm. Most testing labs put this number at 25-30 or even higher.
- Primo MaxxTM did not practically alter the STP critical point but did reduce P removal during mowing by 32%.
- Phosphorus was rapidly fixed by the soil of this young putting green and may justify more frequent soil sampling compared to older putting greens.
- Application of P fertilizer rapidly corrected P deficiency symptoms. Accumulation of N beneath P deficient turfgrass may cause P treated turf respond with greater color and growth rate.

References

Kussow, W., and S. Houlihan. 2006. The new soil test interpretations for Wisconsin golf turf. *The Grass Roots*. 35: 19-23, 25.

Figure 4. A few drips of P fertilizer from a leaky spray nozzle caused the green streak cutting through this otherwise P deficient plot.

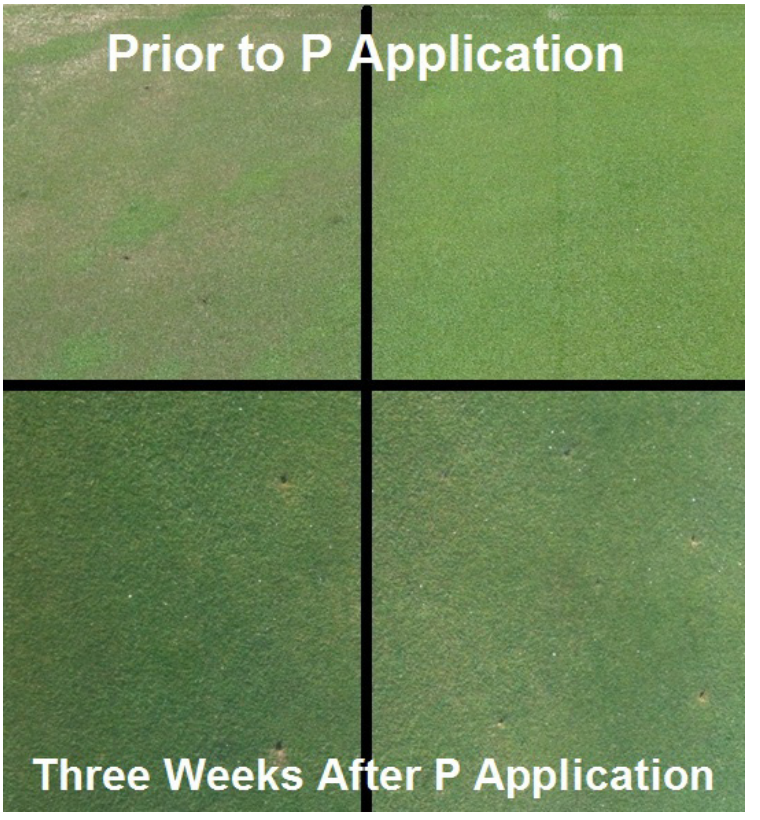

Figure 5. A blanket phosphorus application was made to all plots after the experiment ended in October of 2010. Three weeks following application the plot on the left had completely recovered from the deficiency while the plot on the right was not affected. The plot on the lower left was more green than the plot on the lower right because nitrogen accumulated in the soil when the turfgrass in that plot was inhibited by the phosphorus deficiency.

Influence of Winter on Plant Pathogens

By Dr. Jim Kerns, Department of Pathology, University of Wisconsin - Madison

With the mild winter we experienced, I have had many questions about the influence of winter on plant pathogens. In other words, will summer diseases be more severe because the winter did not "kill" the inoculum from the previous fall. This question is valid because disease can be predicted based on inoculum density (how much inoculum) and inoculum potential (energy needed to initiate infection). These two terms are frequently used in plant pathology, but are rarely studied in any detail. Inoculum density can be determined relatively easily, yet one must understand what the form of inoculum is. Once the source of inoculum is known (ie spores, hyphae, sclerotia, etc.) then all a researcher has to do is simply count the number of propagules per unit area. However, the number of propagules does not always equate to disease severity because the inoculum potential differs for each plant pathogen. As I mentioned earlier, inoculum potential is the measure of the energy or capability that a pathogen needs to infect a plant. This particular term is very hard to quantify and is why predicting diseases based on inoculum density is problematic.

Understanding these two terms are vital when considering if our mild winter affected inoculum densities of our summer pathogens. It is true that a mild winter would definitely limit the loss of viable inoculum deposited in late summer or early fall. However, we do not understand how efficient our inoculum is at causing disease. We may only need one or two units of inoculum for dollar spot or anthracnose to induce an epidemic. These are the unknowns when trying to answer the question about the effects of a mild winter on our summer fungal problems. The other issue is we really do not have a good understanding of how our summer pathogens survive. For many years, turfgrass pathologists claimed that the dollar spot fungus overwintered in thatch and soil as hyphae and stroma (a specialized survival structure). Yet, when Renee Rioux (Ph.D student in my program) attempts to isolate the fungus she can only find it closely associated with plant tissue. Thus from our preliminary evidence it seems like the dollar spot fungus overwinters inside living plant tissue. If this turns out to be true, then the winter temperatures have little impact on dollar spot development.

I do believe that less inoculum died during this past winter, but I do not think that will translate into more disease this summer.

As for our other summer diseases like anthracnose, summer patch, brown patch, Pythium blight, anthracnose and take-all patch, we still do not have a good grasp on how much inoculum is needed to initiate an infection. All of the fungi that cause the aforementioned diseases are common soil inhabitants and in many cases produce survival structures that have evolved the ability to tolerate extremes in weather. It is true that the mild winter probably did not kill off as much inoculum when compared to previous winters, but we still do not know what environmental conditions we may experience this summer. In my humble opinion, the winters affect our summer diseases minimally because I continue to stress that the most important aspect of the disease triangle is environment. We know year in and year out we have enough inoculum present for disease to occur, so the only driving factor are the environmental conditions during the summer months. I do believe that less inoculum died during this past winter, but I do not think that will translate into more disease this summer. Once again we are at the mercy of Mother Nature when it comes to what this summer holds. The only thing we can guarantee is that the TDL and myself will be ready to help WGCSA members with whatever happens during this season!

On a personal note, I would like to thank the members of the WGCSA for their continued support of the TDL. Without the constant support from the industry the TDL would have evaporated long ago. At GIS, in Las Vegas Brett Grams asked if Paul would be willing to help with a 50/50 raffle at the Wisconsin Room and this was a huge success. You all purchased $1100 worth of tickets during the event. This is absolutely remarkable because the money came from your own wallets!! Furthermore, the eventual winner of the raffle, Randy Dupont, donated everything back to TDL! From Paul, myself and the entire turf team at UW, thank you very much for your support of our program!!

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Supporting the UW: Then, Now, and in the Future.

By Paul Koch, Turfgrass Diagnostic Lab Manager, O.J. Noer Turfgrass Research and Education Facility

Having just returned from the Golf Industry Show, it was great to see so many familiar faces and catch up with superintendents, assistant superintendents, and sales representatives I hadn't seen in awhile. In addition, the success of the 50/50 raffle at the Wisconsin Room that raised $1,135 in support of the Turfgrass Diagnostic Lab (in large part to winner Randy Dupont graciously donating his winning half back to the TDL) was both extraordinary and humbling. It served as a reminder of the incredible support the Wisconsin turfgrass industry as a whole gives not only to the TDL, but the entire University of Wisconsin turfgrass program. The support goes beyond pure financial support, as leadership from many individuals within the industry has led to the building of the OJ Noer Turfgrass Research and Educational Facility, the hiring of both Dr. Doug Soldat in Soil Science and Dr. Jim Kerns in Plant Pathology, and the establishment of four distinguished fellowships to support turfgrass graduate students.

Changing dynamics in the turfgrass industry make donating valuable and scarce membership resources towards university research increasingly difficult. Changing dynamics in the availability of federal funding at the University of Wisconsin (and all public universities) has made the importance of those industry donations more valuable than ever. A fuller understanding of the industry's support in the recent past and what those resources are used for at UW will illustrate what is needed to ensure Wisconsin remains an active and influential center of turfgrass research well into the future.

Financial Support

In the last five years (2007-2011), the financial support the varying turfgrass industries have provided to the University of Wisconsin and the Turfgrass Diagnostic Lab has been phenomenal (Table 1). The mission statement of the Wisconsin Golf Course Superintendents Association (WGCSA) doesn't expressly mention the support of turfgrass research, but they have provided considerable support nonetheless. According to numbers provided by WGCSA Executive Director Brett Grams, the WGCSA has provided $157,835 towards scholarship and research since 2007. Not all of this has gone to UW research, as portions have gone to other worthy causes such as legacy scholarships or the Environmental Institute for Golf, but the vast majority (over 80%) has gone to support UW.

Most of this money has gone to support research at UW, but other donated funds include a yearly donation of $1,500 to support the J.R. Love scholarship for a UW undergraduate turfgrass student and at least $1,500 to support the Turfgrass Diagnostic Lab. Maybe a more important aspect than the overall dollar amount of support by the WGCSA has been the recent upward trend of research support from the WGCSA.

As recently as 2009, the scholarship and research donations from the WGCSA totaled $17,000, but in 2011 the scholarship and research portion totaled $45,925. This increase has been fueled by new, innovative methods of raising funds for research highlighted by the successful Par4Research auction held during the week of The Masters. Innovative methods for raising funds such as Par4Research and the recent 50/50 raffle at the WGCSA's Wisconsin Room will be increasingly important as more traditional forms of research donations become harder to sustain.

In contrast to the wider range of responsibilities that WGCSA members expect from its association, the Wisconsin Turfgrass Association's (WTA) mission is much simpler and straightforward. From the front page of its website, the mission of the WTA is to "support turfgrass research and education at the University of Wisconsin-Madison. This includes funding of programs in turfgrass management and allied disciplines that enhance the understanding and general knowledge of the art and science of maintaining turfgrass."

According to numbers provided by WTA treasurer Mark Kienert and WTA ambassador Monroe Miller, the WTA has provided over $204,000 since 2007 directly to UW professors and the TDL. Some of this funding has gone to support research, while other portions have gone to support specific graduate students. This number is misleadingly low, though, as it does not include several large aspects of the WTA's support. The WTA has contributed $7,400 in support of undergraduate scholarships, and also supports the majority of WTA secretary Audra Anderson's salary. Also not included in the $204,000 figure is the approximately $200,000 the WTA contributed to the University of Wisconsin to hire Drs Soldat and Kerns, the many hundreds of thousands of dollars contributed to the university for the 4 distinguished fellowships supporting turfgrass research, as well as the land purchase and construction of the OJ Noer Turfgrass Research and Education Facility (more on these later).

A 3rd source of significant funding for research at UW has come from the Northern Great Lakes Golf Course Superintendents Association (NGLGCSA). Much like the WGCSA the NGLGCSA does not exist solely to support turfgrass research and education, but their contributions have still been hugely significant. According to NGLGCSA treasurer Randy Swonger, the NGLGCSA has donated $28,000 to UW research projects since 2007. Making this total even more impressive is that since the association also encompasses portions of Michigan and Minnesota, significant support has also been donated to both the University of Minnesota and Michigan State University. Many of the projects the NGLGCSA has helped fund have been of specific concern to their members that may receive little interest and funding from other organizations, often involving snow mold control or managing turf under harsh winter conditions.

Significant funding has even been found outside of the three primary state turfgrass organizations. The TDL has received $110,425 from contract members since 2007, providing critical support for a diagnostic lab that doesn't receive any state or university support (Table 2). Significant private funding has also been achieved by each department in the turf program through the testing of fungicides, insecticides, herbicides, fertilizers, and wetting agents. Lastly, though not directly financial many private companies donate equipment, pesticides, and fertilizer that are critical to the continued operation of the OJ Noer center (Table 3). While comparing university support from surrounding states is difficult because of different funding models, the level of support UW receives from its state organizations compares very favorably to those in surrounding states and around the country.

INDUSTRY SUPPORT	
WGCSA	$157,835
WTA	$211,400
NGLGCSA	$28,000
TDL CONTRACTS	$110,425
TOTAL	**$507,660**

Table 1. Financial Support from the Wisconsin Golf Course Superintendents Association (WGCSA), the Wisconsin Turfgrass Association (WTA), the Northern Great Lakes Golf Course Superintendents Association (NGLGCSA), and Turfgrass Diagnostic Lab members from 2007-2011.

Leadership Support

The financial support for turf research at UW is no doubt critical to the success of the program, but in some instances more is needed and has been provided by the different organizations. Probably the most significant example of leadership the Wisconsin turfgrass industry has provided to the UW Turf program has been the design and construction of the OJ Noer Turfgrass Research and Educational Facility. Prior to the construction of the facility in 1992, most research was done at area golf courses or other temporary plots. Being one of the last significant turf programs in the country without a turfgrass research facility allowed members of the Wisconsin Turfgrass Association to tour many of the stations already present around the country, and interview faculty and staff at other universities to determine what they wished they had. The result is the facility you see today, which is one of the most well respected facilities in the country and allows for the faculty and staff to not only do field research but also to complete office work. While on the surface it might not seem to be important, if there is no place for office work to be completed less time can be spent at the research facility, making the entire facility less valuable. Amazingly, the WTA purchased the land and constructed the facility on its own and sold the Noer to the UW for $1.

Most universities brag if they have one graduate fellowship specific for turfgrass... Wisconsin modestly has four.

Further leadership by the WTA and WGCSA was apparent following the retirement of longtime soil scientist and turfgrass researcher Dr. Wayne Kussow. Budget constraints within the College of Agriculture and Life Sciences (CALS) at UW meant Dr. Kussow's position was well down the list to be refilled. During a meeting with CALS representatives, Wisconsin turfgrass representatives offered to pay $100,000 towards the first year of salary and benefits for the future hire if it was refilled immediately. This was an innovative and radical move that had never before been done with any other position in CALS, and resulted in the hiring one year later of Dr. Doug Soldat. A few years later, the same process repeated itself following the departure of Dr. Geunhwa Jung to the University of Massachusetts and resulted in the hiring of Dr. Jim Kerns. Innovative thinking and strong leadership led to the rehiring of two faculty positions much faster than they would without the contributions, and it could be argued that the deteriorating state and college budgets would have prevented one or both positions from ever being rehired.

If those two examples aren't indicative enough of the leadership and support the industry provides, the establishment of four distinguished graduate fellowships in turfgrass research prove that the Wisconsin industry is a nationwide leader in terms of the level of support and leadership provided to for research and education. Each graduate fellowship provides funding for salary and benefits of one graduate student, which can run upwards of $35,000 per year. Most universities brag if they have one graduate fellowship specific for turfgrass…Wisconsin modestly has four. Funds raised from the annual WTA golf outing go to support the Wisconsin Distinguished Fellowship program, so your attendance at this golf event is a way to directly support UW turfgrass research.

As mentioned briefly before, the WGCSA has done a superb job of creating new ways to offer support to the UW. The most prolific recent example has been the creation of the Par4Research program, which takes donated rounds from golf courses around the state and region and auctions them off to the general public. While still in its infancy, the program has proved itself a substantial success and will no doubt continue to grow as word of mouth amongst golfers continues to spread about the potential to play some of the state's best (and private) courses for a fraction of their normal cost. The Par4Research is truly an organization-wide effort, as donations pour in from the member courses themselves and the success of the auction truly rests on the dedication of the members. In addition, other creative ideas such as the 50/50 raffle may offer relatively modest amounts of money, but they are fun and easy ways to provide crucial funds in a creative way as budgets across the nation tighten.

Table 2: A list of the 2011 Turfgrass Diagnostic Lab Contract members. Members in bold are $1,000 level members.

Abbey Springs CC	Agrium Advanced	Antigo Bass Lake	Blackhawk CC
Blue Mounds CC	Bristlecone Pines GC	Big Foot CC	**Blackwolf Run**
Blue Mounds Golf and CC	Brown County GC	Bulls Eye CC	Chenequa CC
Eagle River GC	Eau Claire CC	Edgewood GC	Fox Valley GC
Frontier FS Coop	Green Bay Packers	Hayward Golf & Tennis	**Horst Distributing**
House on the Rock Resort	Koshkonong Mounds GC	La Crosse CC	Lake Arrowhead
Lake Geneva CC	Lurvey Farms	Maple Bluff CC	Milwaukee Brewers
Milwaukee CC	Minocqua CC	New Berlin Hills	New Richmond GC
North Hills CC	**North Shore CC**	North Shore GC	Oconomowoc CC
Olds Seed Solutions	Oneida Golf & CC	Oshkosh CC	Paul's Turf & Tree
Pine Hills CC	Portage CC	Racine CC	Reedsburg CC
Reinders	Rhinelander CC	Rolling Meadows GC	**SAS Management**
Sentryworld GC	Silver Bay CC	South Hills CC	**Spring Valley Turf**
Stano Landscaping	Summit Seed	**Syngenta**	**The Bruce Company**
The Legend at Bristleone	Tripoli CC	Tuckaway CC	Twin River Turf
Two Oaks North GC	University Ridge GC	Volkening Consulting	Watertown CC
Weed Man Lawn Care	West Bend CC	Westmoor CC	Whispering Pines GC
Whistling Straits GC	Wistl Sod Farm	Zimmerman Kettle Hills	

Table 3: Private companies, golf courses, and individuals that provided support of the UW Turfgrass Program in 2011.

Abbey Springs GC	AgraQuest	Andersons	Aquatrols
Badgerland Irrigation	Bayer CropScience	BASF	Blackhawk CC
Blackwolf Run GC	Brown County GC	The Bruce Company	CALS/ARS
Cascade International Seed	CTBT	Cedar Creek CC	Cenex/Land O' Lakes
Chippewa Valley GC	Cleary Chemical	Cole Grower Service	DHD Tree Products
Dow Agrosciences	Dupont	Eagle Creek GC	Eagle River GC
Floratine Products Group	FMC	GCSAA	Green Bay CC
Greenwood Hills CC	Gowan	Honeywell Inc	Horst Distributing
Hynite Corporation	ISK Biosciences	Jacklin Seed	Janesville CC
John Deere Landscapes	Keyman Lawn Care	LL Olds Seed	Lebanon Seaboard
Madison Metro Sewerage	Merrill Hills CC	Microflo	Milwaukee CC
Milorganite Division, MMSD	Nitragin Inc	Northern Great Lakes GCSA	Oconomowoc CC
National Turfgrass Evaluation Program		Old Hickory CC	Pennington Seed Inc
Pine Hills CC	Paul's Turf and Tree	PBI Gordon	Plant Health Care, Inc
ProSeeds	Pure-Seed Testing	Quality Liquid Feeds	Quali Pro
Reinders Turf & Irrigation	Royal St Patricks GC	Seed Research of Oregon	Sentryworld GC
Spring Valley	Summit Seed	Syngenta	The Scotts Company
Toro Inc	Turf Merchants Inc	Turfgrass Producers International	
UAP	University Ridge GC	US Dept Agriculture - CSREES	
United States Golf Association	Valent Corp	Vital	Voyager Village GC
Watertronics	Wawonowin CC	West Madison ARS	Westmoor CC
Wisconsin GCSA	Wisconsin Turf Equipment	WI Sod Producers Assoc	
WI Sports Turf Managers	WI Green Industry Fed		

What happens once the money gets to Madison?

The above sums of money are truly impressive, and members of all three organizations as well as any company that makes a private donation should wonder where their support goes. In nearly all cases the money provided to UW goes directly to support turfgrass research. But what does supporting a research project truly entail (Table 4)?

Similar to most golf course budgets, 'labor' is the largest cost of any research project. Often a significant portion of research project support will go to fund the graduate student leading the effort on that specific project. Funding for the graduate student's stipend, benefits, and tuition can approach $50,000 per year, and over the 5-6 year period it often takes a graduate student to obtain his or her degree the total funding needed to support that student can begin to approach $250,000. Multiply that by 3 or 4 graduate students often found in a lab and the total funding required to support those graduate students over the course of their career can begin to approach $1,000,000.

In addition, undergraduate part-time support is needed both during the growing season and during the school year, which for the Turf Pathology program here at UW costs over $20,000 annually and is similar to what the other programs spend. Undergraduate support is required to mow the plots, help apply treatments, help with laboratory experiments, and a myriad of other duties. Other research stations in the UW System have the staff available to perform nearly all the maintenance, but the OJ Noer is not provided the funding to do this so the programs must provide their own labor.

Lastly, most turfgrass labs have a staff member employed that can assist the professor in managing the barrage of activities going on at any one time, and can add approximately $70,000 in salary and benefits to the 'labor' portion of the annual budget. A typical lab may have 3 graduate students, 3 undergraduate part time employees, and a staff member, costing the program nearly $250,000 annually.

This cost doesn't count any of the supplies needed to perform a study. Cost of supplies for a research project can vary widely, from just a few thousand dollars needed for hand tools or travel to the site to over $100,000 needed to purchase fungicide analysis kits for the snow mold and summer fungicide degradation projects. Other project-related costs include supporting the travel of graduate students to academic conferences to present the findings of their research, and printing and submission costs required for publishing the research findings in a research journal.

There are other costs not tied directly to a specific research project but that can require considerable sums of funding. One of the most significant is the purchasing and repair of equipment at the OJ Noer center. While much of the equipment is donated, equipment purchases in the past couple years have included new riding lawn mowers for general maintenance, riding cultivator for plot preparation, and even some used walking greens mowers. Repair costs for both machinery and the irrigation system has increased as the wear and tear on these aging pieces of equipment begins to take its toll. Costs for purchasing and repair of equipment has exceeded $20,000 annually in the recent past, and is money that has not been provided by the university but instead needs to be found from within the programs.

The research funded at UW now can result in significant improvements to the ways turfgrass is managed in the future. A few examples of recent UW research funded in part by the different state organizations include development of a growing degree model to improve the application timings of plant growth regulators, effects of snow cover on fungicide degradation, proper timing of fall fertilization, velvet bentgrass management in the shade, and development of a mathematical model to predict dollar spot outbreaks. Anywhere between 80 and 90 research projects have been ongoing at the OJ Noer Research Facility and elsewhere in recent years, and the vast majority of those would not be possible without some support from the state organizations. Significant issues that may affect your ability to manage turfgrass, including significant water and/or pesticide restrictions, loom in the near future. It is with the support of credible university research that the effects of these and other future restrictions can be mitigated or managed. This has already been seen with the recent removal of the strict limit on turfgrass in a landscaped area that the Environmental Protection Agency had planned to implement in its new WaterSense® Program for home lawns until input from turfgrass scientists was considered.

Where do we go from here?

First off, as members of the WGCSA you and all the members of the WTA and NGLGCSA should be commended for the support you provide to the University of Wisconsin. But challenges loom on the horizon, and maintaining the current level of support and leadership will not be easy. Drastic cuts to the university budget from both Democratic and Republican Wisconsin governors in the past 5 years may not seem like they should affect the turfgrass program, but they undoubtedly will. In 2010-2011 CALS lost 27 faculty members to retirement or departure.

TDL
TURFGRASS DIAGNOSTIC LAB
O.J. Noer Turfgrass Research and Education Facility
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Email: plkoch@wisc.edu
Website:http://tdl.wisc.edu

	Approximate Dollar Amount	Approximate Percentage
Graduate Student stipend, benefits and tuition	$50,000	30-65%
Undergraduate labor*	$20,000	12-26%
Supplies and travel	$5,000-$1000,000	7-58%
Conference travel	$2,000	1-3%
Total	$77,000-$172,000	

*Undergraduate labor estimate is for assistance with many studies over the course of an entire growing season.

Table 4: The breakdown of the cost of a typical turfgrass research study at the University of Wisconsin over the course of a year. Values for undergraduate labor and supplies are estimated and can vary widely.

Because of budget constraints the college decided in late 2011 they would replace approximately half of them. But in early 2012, when tax collections didn't meet expectations an additional significant cut was levied at the UW system by the state, and the college could only afford to rehire 4 of those 27 departures. That's a net loss of 23 faculty members in just one year, or just under 10% of the total college faculty. If you don't think that's important, remember that UW's turf program will likely be looking to refill its turfgrass physiologist in the near future, and will be competing with each one of the 19 departments in CALS to get their position hired.

The changing shape of turfgrass education at the university-level means more work, leadership, and likely financial support will be needed by the Wisconsin turfgrass industry to convince the administrators at the university that support for the turf program is essential. As the demand for turfgrass students has decreased along with decreasing job availability, the supply of undergraduate turfgrass students at UW and many other universities has decreased dramatically in just the past 5 years. Wisconsin, like many other universities, now has nearly as many graduate students in the turfgrass program as undergraduate students. Convincing university administrators that a program with approximately 10 undergraduate students requires 4 faculty members will not be easy, and will require intelligent, creative, and persistent discussion.

The upside is that the new Dean of the College of Agriculture and Life Sciences, Kate VandenBosch, just started her position March 1st and has neither a negative or positive perception of the turf program here at UW or the turf industry in Wisconsin. It should be a primary goal of all involved with the turf industry in Wisconsin to make a favorable first impression and educate her on the value of a strong turf program to both the college and the state. It also helps that Dr. Birl Lowery, who has been involved with the turf program for several years, is now a Senior Associate Dean with CALS and knows the value the turf industry serves to the state.

Convincing university administrators that a program with approximately 10 undergraduate students requires 4 faculty members will not be easy, and will require intelligent, creative and persistent discussion.

For those that think the turf program at Wisconsin is too big and too strong to face an uncertain future, a warning to the contrary is only a state away. Only a few short years ago the turf program at the University of Illinois had a turf program larger in size and stature to the one at Wisconsin. The program boasted of five full time turf faculty, 25 undergraduate students, and influential research emanating from the many graduate students graduating from the program. Today the program consists of only 1 full time faculty member in turfgrass (Dr. Bruce Branham), and only a handful of undergraduate turfgrass students. While a lack of support from the Illinois turfgrass industry is not to blame for the decline of that program, it illustrates the fact of how quickly a program's fortunes can change.

The model for how to maintain and strengthen the UW turf program is not complicated, and in fact is already in place. There is widespread involvement in the planning of research by a diverse group of organizations and superintendents offering up ideas for research, places for research, and financial support through their organization memberships and TDL contracts. There is excellent leadership at the helm within each organization, with strong ideas about the continued benefits of supporting turfgrass research at the UW. Will young superintendents fill the leadership roles vacated as current leaders retire or step down? If so, will they have the same commitment to supporting UW as their predecessors? As one Wisconsin Room attendee told me last week, "we're pretty lucky to have such a strong team here at little ol' Wisconsin." I would counter that luck plays only a minor role, and years of creative planning, leadership, and support from the state organizations has made Wisconsin the program it is today. The only question remaining will be if the past and current leadership will continue as new, unique challenges emerge that may threaten the health of the program.