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Poa Annua Invasion of a Bentgrass Fairway

By Dr. Wayne Kussow, Emeritus Professor, Department of Plant Soil Science, University of Wisconsin-Madison

When you retire, one of the things you have to do to maintain domestic tranquility is get rid of those boxes and boxes of stuff. Some things are easy to toss because you can't for the life of you remember why you kept them in the first place. Other items have nostalgic value. And, in my case, there are all those folders full of research data that appeared in bits and pieces in annual research reports or The Grass Roots but have never been pulled together into a summary report. This is one of those summary reports.

This research project pre-dates the Noer Facility. It was conducted between 1987 and 1990 on a site graciously provided by Tom Harrison and maintained by his crew at the Maple Bluff Country Club. The primary purpose of the study was to investigate the claim that application of Milorganite to creeping bentgrass encourages Poa invasion by elevating soil test levels of P. This was at a time when two highly reguarded d turfgrass researchers had cited research conducted in the late 1930's at Rutgers University. One claimed the research showed that high levels of P encouraged Poa invasion of bentgrass while the other claimed the research gave no such evidence. A secondary objective of this study was to determine how N rates and type of fertilizer influence selected characteristics of a creeping bentgrass fairway.

Sod was stripped from the experimental site, the soil prepared, and the site seeded to 'Penncross' creeping bentgrass in August 1987. The area was divided into four blocks of 7 x 10 feet main plots that received bi-weekly applications of fine grade Milorganite (FM) or 7 monthly applications of regular grade Milorganite (RM), urea, or IBDU at annual N rates of 2.4, 4.8, and 7.2 lb/M. To ensure a wide range in soil test P, the main plots were split for periodic applications of triple superphosphate. By the spring of 1988 the bentgrass was grown in and being mowed at a height of 7/16 (0.44) inches. The plan was to uniformly overseed the site that fall with Poa annua. This plan was set aside because Poa begun to naturally invade the plots that year. But because the Poa populations from this natural invasion were so low, the plots were overseeded in August of 1989 with seed collected from a Poa infested Madison fairway. The overseeding rate was 0.1 lb/M of viable seed.

Starting in 1988 all plots were rated weekly for color and clippings collected for N analysis. Verdure (the weight of above ground green material remaining after mowing) and root samples to 6 inches were periodically collected. Poa populations were determined by counting the number of inflorescences at times of seed set. For reasons that will become evident later in this report, numbers of earthworm casts were also periodically counted.

OBSERVATIONS

Poa Annnua Invasion

Over the course of the study Poa populations ranged from 5 to 132/m2 (464 to 12,400/M) and soil test P ranged from 36 to 188 mg/kg (ppm). Yet, there was never any meaningful relationship between the two (Fig. 1), clearly demonstrating that at least in this study soil test P levels had no influence on Poa invasion. Poa populations were several times higher in the Milorganite plots than in those fertilized with urea and IBDU. Careful scrutiny of the plots revealed two things. One was that the Milorganite plots had much greater earthworm activity (more casts) than the urea and IBDU plots. The other was that Poa was establishing almost exclusively in those casts. This made sense given that the casts were providing gaps where the Poa had minimal competition from the creeping bentgrass while providing moist, well granulated, nutrient enriched soil as the growth media.

Not surprisingly, Poa populations were strongly related to numbers of earthworm casts, even in the urea and IBDU plots (Fig. 2). This reflects the well known fact that gap development by any means in closely mown bentgrass enhances Poa invasion, particularly when the gaps are present when the Poa is setting seed.

Is the elevation of earthworm activity and subsequent accentuation of Poa invasion unique to Milorganite? Absolutely not. Researchers at Michigan State University have clearly shown that for soils with properties that favor earthworms, repetitive application of any natural organic fertilizer stimulates their populations. A likely reason is that the fertilizer actually serves as food for the earthworms.

Earthworm activity did not account for all the variability seen in Poa invasion of the plots. Another factor that came into play at times was bentgrass verdure. This was particularly true for the Milorganite plots (Fig. 3). While the data presented in this figure suggest that the reductions in Poa populations with increasing verdure in the urea and IBDU plots were not significant, increases in verdure was associated with over 50% lower Poa populations over the single 1990 season. Hence, verdure cannot be ignored as factor that influences Poa invasion of a creeping bentgrass fairway.

Fertilizer Influences on Bentgrass Fairway Characteristics

Verdure was influenced by N rate and the type of fertilizer applied (Fig. 4). Fine grade Milorganite applied monthly resulted in consistently lower verdures than did the monthly applications of regular grade Milorganite, urea or IBDU and IBDU produced higher verdure than any other fertilizer. Why did these differences arise? The answer appeared to lie in the relationship of verdure with bentgrass clipping N content and how this varied with the type of fertilizer applied.

Averaging across all sampling dates, verdure was strongly dependent on clipping N, so much so that clipping N accounted for all but 15% of the variation in bentgrass verdure (Fig. 5).

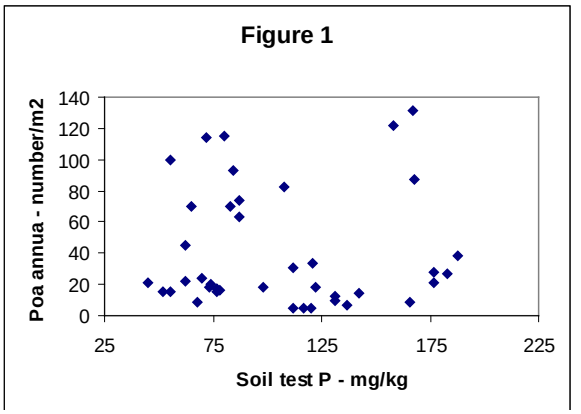

Figure 1: Phosphorus Levels had no influence on poa invasion.

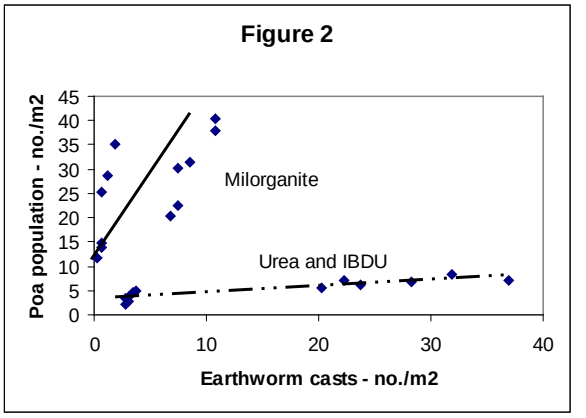

Figure 2: Poa Annua populations were strongly related to the number of earthworm casts.

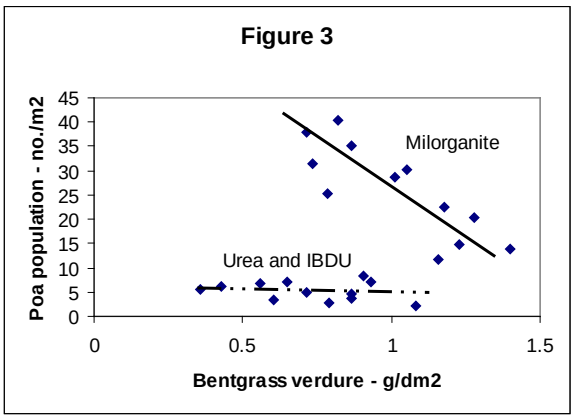

Figure 3: At times bentgrass verdure is a factor in earthworm activity.

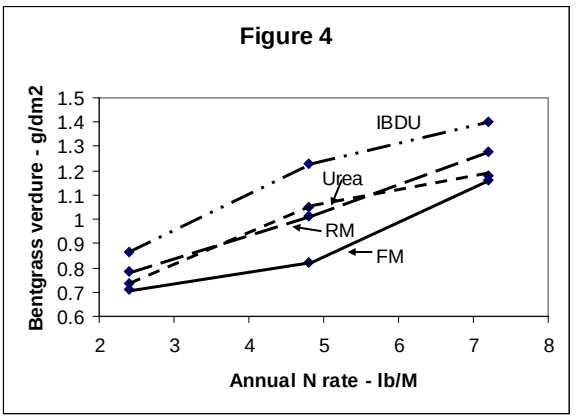

Figure 4: Bentgrass verdure was influenced by N rate and the type of fertilizer applied.

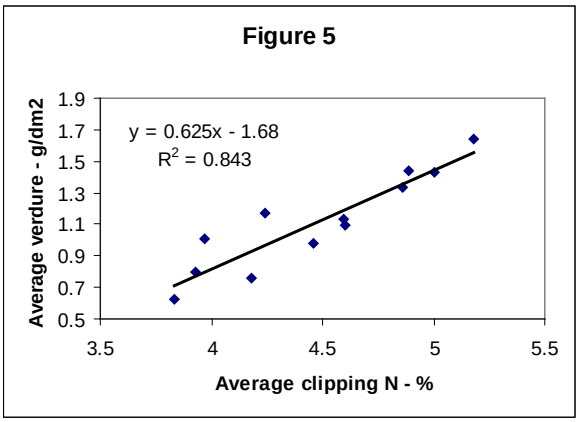

Figure 5: Clipping N accounted for all but 15% of the variation in bentgrass verdure.

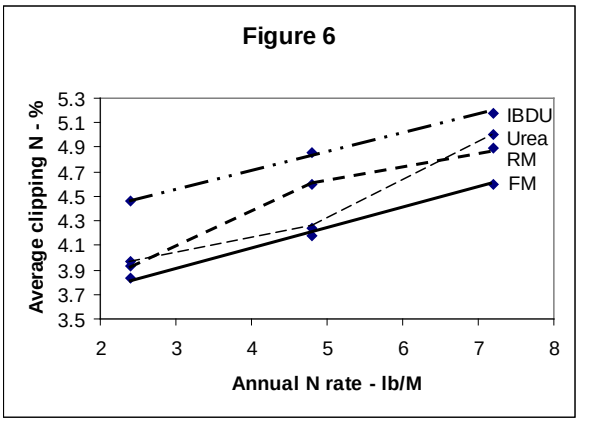

Figure 6: Annual N rate from different products does not equal clipping N.

Judging from figure 6, among the four fertilizers N utilization by the bentgrass was lowest for the fine grade Milorganite and highest for IBDU. These differences in bentgrass response to the various fertilizers N and the dependency of verdure on clipping N explain the joint influences of N rate and type of fertilizer on verdure (Fig. 5).

The bentgrass verdure also showed a seasonal trend that was consistent across the three annual N rates (Fig. 7). Verdure was highest in late season and lowest in the summer months. The low verdure values in July and August likely facilitated Poa invasion at that time of year and may explain in part why Poa populations typically increase in the fall months after declining during summer.

Tiller densities were determined on 8 dates during the course of the study to provide yet another measure of bentgrass stand density that might relate to the rate of Poa invasion. These densities increased with annual rate of N application, varied with the type of fertilizer applied, and displayed the same seasonal patterns as verdure. Yet, tiller density did not appear to have any consistent influence on Poa populations (Fig. 8). If anything, higher Poa populations were associated with the higher tiller densities. More detailed inspection of the data revealed what other researchers have observed – the higher tiller density the lower the weight per tiller. Increasing tiller density did not compensate for these reductions in tiller weights. As a result, the increases in tiller densities did not necessarily translate into comparable increases in verdure.

Thatch thickness had no influence on Poa invasion of the creeping bentgrass fairway. This came about because thatch thickness did not vary with annual N rate or type of fertilizer applied. Thatch thickness averaged 6.4 mm in 1988 and 1989, but inexplicably increased 64 % to 10.5 mm (0.4 inch) in 1990.

Root densities were observed, not with the idea that this in some way related to Poa invasion, but to record the effects of N rates and types of fertilizer applied on root growth. The data corroborated the well known fact that any cultural practice that stimulates turfgrass shoot growth results in reduced root development. In this study, root density linearly decreased with the annual N rate that accounted for 87% of the fertilizer treatment effects on root density (Fig. 9).

Seasonal cycling in root densities was also evidenced. The seasonal pattern of root development was basically the same in all fertilizer treatments. Data from the IBDU treatment at the 4.8 lb annual N rate illustrate the seasonal pattern of root density (Fig. 10). As expected, root density was lowest in August. The tremendous increase in root densities between November and May was not anticipated. What this tells us is that this is a crucial period for root system regeneration and may indicate the importance of late season N fertilization. In this study N applications extended into mid-October.

CONCLUSIONS

Application of Milorganite to a creeping bentgrass fairway where soil properties are favorable for earthworm growth can promote invasion by Poa annua. This has nothing to do with the influence of Milorganite on soil P levels. Rather, the key causative factor is increases earthworm populations. Research tells us that this phenomenon is not unique to Milorganite, but will result from repetitive applications of any natural organic fertilizer.

High turfgrass verdure retards bentgrass fairway invasion by Poa annua. Turfgrass verdure linearly increases with annual N rate. Verdure can also vary with the type of fertilizer applied. Differences among fine and regular grades of Milorganite, urea and IBDU in the level of verdure produced were solely the result of how efficiently bentgrass utilized the N from the fertilizers. Among the four fertilizers, IBDU produced the most verdure and resulted in the highest bentgrass clipping N concentrations.

Fertilizing to maintain a high verdure in a creeping bentgrass fairway is not advisable because of the detrimental effects of high N rates on root development. According to the results of this study, maintenance of a moderate annual verdure level of 1.0 g/dm2 could have been achieved with annual applications of 6.2 lb N/M in the form of fine grade Milorganite, 4.0 lb N/M as regular grade Milorganite, 2.6 lb N/M as urea, or 2.2 lb N/M as IBDU. These annual N rates translate into 0.3 to 0.6 lb N/M/month.

Figure 7

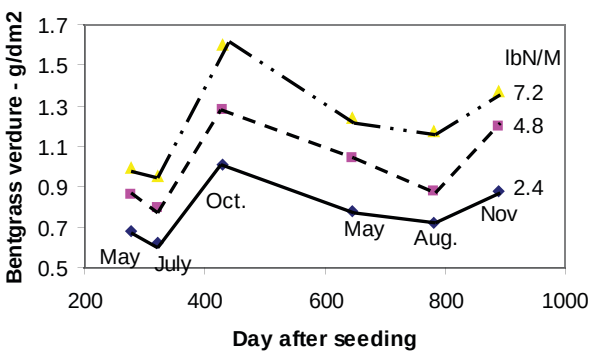

Figure 7: Verdure was highest in late season and lowest in the summer months.

Figure 8

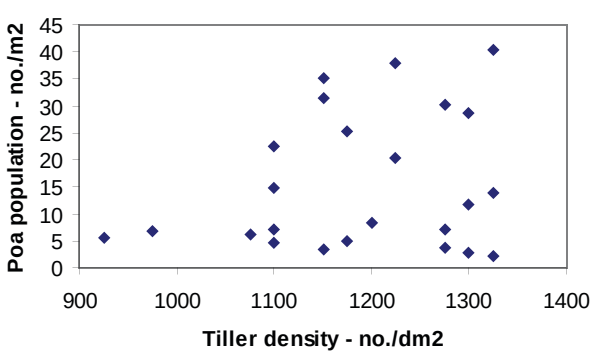

Figure 8: Tiller density did not appear to have any consistent influence on Poa populations.

Figure 9

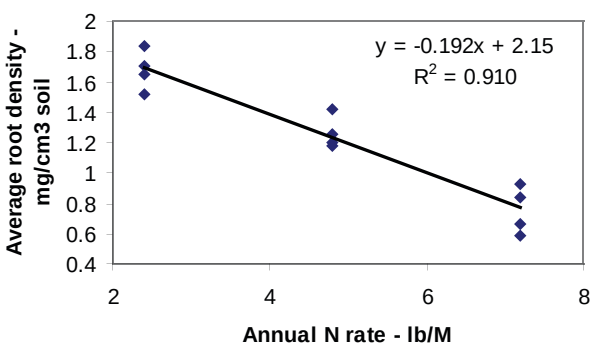

Figure 9: Root density linearly decreased with the annual N rate.

Figure 10

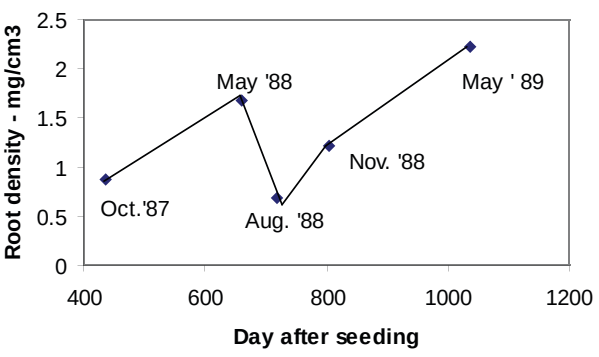

Figure 10: The seasonal pattern of root development was basically the same in all fertilizer treatments.

Grateful

By Jake Schneider, Assistant Golf Course Superintendent, Blackhawk Country Club

In the January/February 2009 issue of The Grass Roots, I wrote the following, "Hopefully, with a little luck and a whole lot of determination, I'll be worrying about my first day as a superintendent in a couple of years." This winter, I had the opportunity to interview for a position that I had been targeting for many years, and suffice to say that I considered it to be my dream job. Going into the interview as the youngest and least experienced candidate, no one had to tell me that I was in for an uphill battle. However, I also felt as if my education and real-world experience were extremely relevant to the position. That, along with the backing of some the state's most legendary superintendents gave me a good deal of confidence going into the interview room.

Prior to getting drilled with questions, each of the committee members were given a binder that I'd prepared for the occasion. After the Q & A session, I gave a PowerPoint presentation that I'd prepared weeks in advance, and I felt as if I'd nailed it. From my perspective, the interview went extraordinarily well, and the interviewers seemed to agree. Walking back to my car, I knew that I had given myself the best chance possible for further consideration, and my head was held high (or as high as it can, given my vertical limitation).

As you can probably guess based on the title below my name not changing, I found out a few agonizing weeks later that I didn't get the job. Man oh man was I bummed. Deep down, I honestly felt as if I was the best candidate, but I also have no doubt that the candidate that they selected will succeed tremendously. Based on the feedback that I received, the fact that I've never been a head superintendent was the main chink in my armor; to which I asked myself, "How am I supposed to be a head superintendent if I'm not a head superintendent?" Pity ensued for the next two-and-half days.

Once the cloud of misery lifted, I realized how lucky that I am on a number of fronts. First and foremost, it was a privilege to even be considered for the position, and it's hopefully a sign that my career is on the right track. I'm fully aware that there are other highly-qualified assistants in this state who have been looking to advance for longer than have I. Secondly, my consolation prize was returning to one of the best and most rewarding assistant jobs in the state. In a time when veteran superintendents are out of work or are subject to seasonal layoffs that are completely out of their control, it's hard to sell a sob story while receiving a consistent paycheck. Plus, my wife's new RN gig has us feeling as if we're downright loaded.

Now that I've had some time to reflect, I still really wanted that job, but not getting it has helped me to refocus on personal improvement. After getting the bad news, a very successful Blackhawk member who I have a great deal of respect for told me, "Not all learning experiences are enjoyable! Your time should be spent on the things you can control." Numerous people have told me that everything happens for reason. The optimist in me tells me that that's true, and I'll be anxiously awaiting what exactly that reason is.

By now, you're undoubtedly asking yourself, "What's the moral of this rambling story?" Well, here it is, you impatient reader… If you've been searching for a gig, keep improving and have faith that good things happen to good people. If you have a job, be grateful, don't become complacent, and bust your hump to do the best that you possibly can. This young man, for one, is going to do exactly that. Hopefully, with a little luck and a whole lot of determination, I'll be worrying about my first day as a superintendent in a couple of years. Until then, I've got it pretty good, and I hope that you do too.

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Low Tech Strategies That Enable the Big Picture

By Bob Lohmann, Founder and Principal Lohmann Golf Designs and Golf Creations.

Editors Note: We welcome back Golf Course Architect Bob Lohmann after a 20+ year break. Readers can research Bob's previous articles at Michigan State Librarys Turfgrass Information File.

All of us in the golf business struggle at times to reckon the old-fashioned, traditional qualities of the game with the technological advances that have so greatly affected the way we play that game — and the way we tend to our courses. But one thing's for sure: Tech isn't going away. The sooner we get a handle on it, the better off we'll be — and the better we'll deal with the next wave of technological advance.

Here's some low-tech ways to think about putting technology to work:

Be historians.

Start with collecting and organizing the data you have. Gather all of the documents sitting in the corner of your office, review them, understand them, and archive them. In short, take on the role of course historian at your facility.

Why? Well, because that information is the stuff you'll need, eventually, to do all sorts of important things, mainly strategizing regarding how best to maintain key aspects of your course and making the case internally for future improvements.

First, take your paper plans and have them scanned into digital format for ease of organization, space and future use. These are the first things architects, contractors and consultants ask for when working with a course client, and digital is the way to go these days — for ease of sharing and, let's face it, digital is built to last. Paper is not.

We suggest scanning to .jpg or .pdf format at a resolution between 175 and 200 dpi, which will give you adequate quality at a manageable file size.

Fig. 1 – Scan historic and current documents into digital format for ease of organization, preservation and future use.

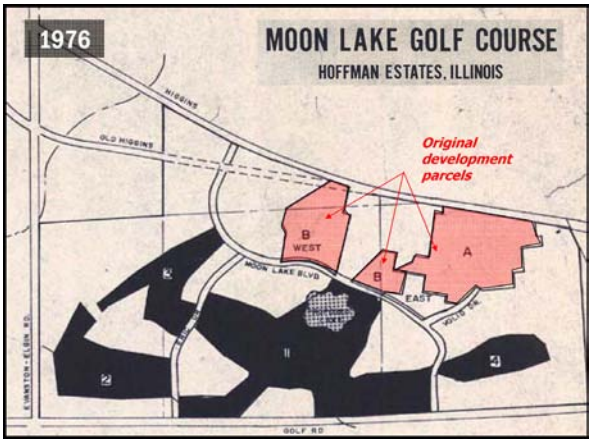
Collect data you don't already have stored and make a record of it, digitally, even if it's a simple Word file or spreadsheet. For example, gather that information that is stored in the brain of your irrigation technician, especially if he/she's the only connection to that info — and get it recorded using GPS. Hire a consultant to help, someone who understands how things are installed so they can interpret the data accurately. Then request all future information in paper and digital format.

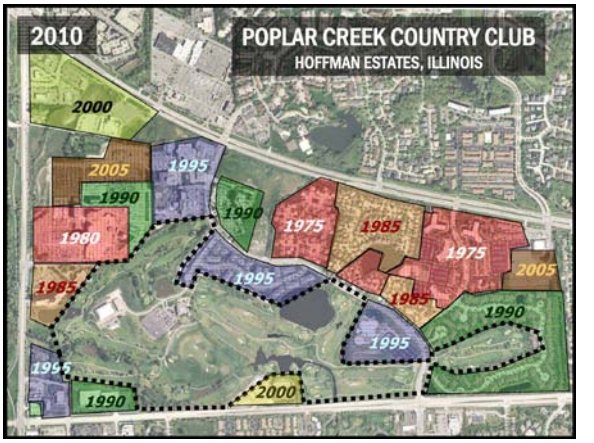
The value of archiving this sort of information is manifold. It allows you to make connections to the past, which in turn allows you to understand the story behind your club. This was vital at Poplar Creek Country Club in Illinois, a municipally-owned facility where we recently wrapped up a major storm water management project. Prior to approval, we illustrated the incredible increase in development around the golf course over the last 30 years, using documents we and the owner had archived. Our data helped paint a picture for the Park Board commissioners and the permitting agencies, so we could illustrate the value and need of our project. More importantly, it expedited the approval process.

Be a "paparazzi."

Take photos of everything. The best way to tell a story is to illustrate it, and for us aging folks, it's also the best way to remember those stories! Proper photo imaging also allows an architect, for example, to demonstrate proposed changes to a particular hole with alarming realism. What, you don't like the bunker there? We'll move it, and here's how it will look over there — think about how much time and trouble that can save in the field!

Again, this sort of digital documentation helps a superintendent sell a project to higher-ups. It's a great tool for marketing and presenting to your boss or to your stakeholder golfers, giving them a feel for things before, during and after the course-improvement process.





Original plans (left) allowed the development of current plans to show the develoment over 30 years. These plans were vital to getting approval for a storm water managment plan for the course.

This type of imaging also allows you to start exploring materials and aesthetics well in advance of actual construction. If you're lucky (and we all know that most luck is "made" by those who are best prepared), you'll ultimately get to build your ideas — then go back and review how they compare to your initial proposals.

It's important to document where and when you took your photos, too. The simplest way is to mark and locate this info on a course map, either by hand or digitally. This allows you to go back later and take the "After" picture in the exact same position. It sounds tedious, but trust me, it'll add a level of authenticity to your story and to your presentations.

Be prepared.

There are all manner of projects that superintendents may wish to undertake that have nothing to with hiring outside help. But all of these projects need to be paid for and staffed. I think most supers have a list of goals for their course, in their heads. Write those goals down in a strategic plan that stretches from daily management, to long-term management, to future renovation. With this list of goals, you can prioritize them and start strategically building your case for funding and logistic support.

One helpful way to think about this planning is the living will. Create one that focuses on the key features of your course. Trees are a good example: Hire an arborist to survey and categorize your trees and assess them for value. More important, do your own assessment that includes a plan of action in the event of a course renovation, a severe weather event, or an unforseen herbicide disaster!

Changes at Westmoor Country Club

Top Left - Hole 8 Before Renovation

Top Right - Digital rendering of Proposed Changes Hole 8.

Bottom Right - Hole 8 as constructed. (Photo courtesy of Epic Creative.)

Clubs should be prepared for potential natural disasters as Jefferson City CC in Missouri faced. A ice storm like this could change a course forever.

This plan is essential to have on hand for discussion and remediation purposes, and the more prepared you are, the easier it is to turn a "tragedy" into an opportunity. Jefferson City CC in Missouri is a great example of how a tragedy jump-started an improvement project. While our firm was trying to gain approval for a renovation program there, which required significant tree removal, the club was hit with a devastating ice storm. The damage was in fact devastating, but it opened up an opportunity: the cost (and shock) of tree removal was covered by insurance money, thus freeing up some dollars in the project budget, and the newly cleared spaces allowed us to reinstate some concepts that had been nixed due to trees. Turns out those improvements are some of the members' favorites.

Be curious.

None of the above steps are, in and of themselves, particularly high-tech. But they all enable the more practical, efficient use of time and resources. They also are great catalysts for the generation of ideas. That last item, the ideas themselves, should not be overlooked. In the design and construction business, we see great technological advance all around us. But technology has its limits, and we feel the best ideas are still fostered through face-to-face discussions and brainstorming.

So we encourage you to be curious. Ask questions. Engage your staff, members and management in discussion and research. Reach out to your colleagues, architects and builders and exchange ideas. Find out what's going on at other courses and in the rest of the industry. But most important, engage the resources at your disposal to thoroughly document and understand your own course's past and present. Then once you've done that, use that information to work towards securing its (and your) future.