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# WHAT'S KILLING MY TURF?!?!

**DON'T BE QUICK TO BLAME DISEASE FOR YOUR TURF WOES. ANY COMBINATION OF ABIOTIC FACTORS MAY BE THE TRUE CULPRITS.**

BY JOHN TORSIELLO

There is a plethora of abiotic causes for poor turfgrass quality, including traffic stress, compaction, improper fertility, incorrect use of pesticides, shade, poor drainage, too much or too little water, high temperature (especially soil temperature), cold injury, and other factors. And all of these issues are one big headache for superintendents who must deal with them on their course's playing surfaces.

"They are widespread. I have seen abiotic issues across the country," says Dr. Lee Miller, extension turfgrass pathologist at the University of Missouri. Black layer, heat stress, drought stress, shade stress, too much moisture, mechanical damage, layering of sand-based putting greens are some of the many problems in turfgrass systems and actually from the perspective of our diagnostic lab they significantly outnumber biotic problems of turfgrass systems."

Common abiotic disorders associated with winter include deicing salt injury, crown hydration, winterkill or low temperature kill, and desiccation. Some of the common abiotic disorders during the growing season include oversaturated soils, compaction, wear, drought, wet wilt, nutrient deficiency or toxicity, and chemical phytotoxicity.

"In our turfgrass diagnostic lab, approximately 50 to 60 percent of the damage in received samples are caused by abiotic disorders and not the result of an infectious disease," Miller says.

"The No. 1 abiotic disorder we observe in our diagnostic clinic is an oversaturated rootzone," he adds. "This condition can be caused by over irrigation or too much organic matter, which acts like a sponge and holds the water. Add a bit of heat or physiological stress onto a creeping bentgrass green with a saturated soil condition, and decline can occur very rapidly. We use the acronym SHRS, or soggy hot root syndrome, to describe this decline."

Other than oxygen deprivation in a pore-filled rootzone, a variety of factors can result in decline. For example, water resiliently holds onto its temperature, so once the soil solution heats up, it takes an extended

duration or level of cool temperatures to bring it back down. Secondly, fungal pathogens such as pythium root rot thrive in a waterlogged soil, and appreciate the resultant weakened and compromised root tissue to infect. Soil nutrients and beneficial aerobic microflora also may be diluted in a flooded soil profile, so nutrient availability for turfgrass health, defense or recovery may be limiting.

Abiotic causes for turfgrass problems can be widespread, and many times they are mistaken as biotic causes, such as turfgrass diseases, says Dr. Brad Fresenburg, assistant extension professor with the University of Missouri's Division of Pant Sciences.

"So if we look at the weather, extreme heat (high soil temps reduce root mass) or cold (extreme cold temps can cause winter desiccation of warm-season grasses like Bermudagrass and zoysiagrass) can have an impact on turfgrass quality," Fresenburg says.

Too much rain (saturated soils reduce soil oxygen and reduce nutrient uptake) versus too little rain (leads to wilting and dormancy) are abiotic. Imbalances of nutrients in the soil can cause symptoms of nutrient deficiencies and slow growth. Ice salt, chemical spills (such as gasoline), misapplications of pesticides, underground gas leaks, animal urine and shade from trees are all abiotic causes to poor quality turfgrasses, since all have an impact on the normal growth of that plant on a continuous basis.

In addition, poor cultural practices for turfgrass management can also be considered abiotic. Mowing too close or scalping the turf can produce poor quality. Lack of soil testing and improper fertilization can lead to nutrient imbalances. Lack of aeration or soil cultivation can lead to compacted soils therefore reducing root mass and leading to a weak plant being more susceptible to drought. Lack of or too much irrigation can have the same impacts as too much rain or too little rain.

Richard Buckley, coordinator of the Plant Diagnostic Laboratory at Rutgers University, believes many researchers and superintendents think of abiotic stress in terms of physical (temperature and moisture extremes), chemical (problems with pesticides, fertilizers,

## What is it?

According to Dr. Brad Fresenburg, assistant extension professor with the University of Missouri's Division of Pant Sciences, the keys to distinguishing between abiotic problems and biotic problems are as follows:

- Disease may start small and increase in size and severity over the period of a few days. "So the idea here is to closely monitor the areas as they develop or if they develop." Mark the perimeters of the affected areas with paint. If it is a disease the perimeter will continue to expand. Typically (there are always exceptions in biological systems) abiotic problems do not expand and if they do they rarely expand at rates typically of a disease.
- Diseases usually develop in random patterns. "The key is to take a step back and examine the distribution of symptoms. Look at the symptoms from the edge of the green or from 15 to 20 yards away and try to see is a specific pattern exists. In other words diseases normally do not develop in squares, triangles, straight lines, etc."
- Look at the perimeter of the affected area closely. The best time to do this is in the morning when dew is present or before temperatures start warming up. If it is an active disease then the perimeter will usually transition from dead to healthy. "In other words many times the perimeter of a disease is typically a different color or the plants are exhibiting different symptoms around the outside of the affected area."
- Examine the soil closely. "Is rooting different between affected and non-affected areas. Ask yourself why? Is there a layering issue? Did I do something that may have induced this? Did we make an herbicide application that could have drifted to this area? Does the soil smell funny? This could mean black layer or anaerobic conditions."
- Look at the individual plants. Are there symptoms that are indicative of a disease? "Use resources to help you such as the Compendium of Turfgrass Diseases. If nothing looks familiar then could nutrition be off? If you don't want to deal with any of this, then send a sample to a diagnostic lab."

and other plant health care products), and mechanical (traffic, scalping, etc).

"I also like to think of damage from abiotic causes in terms of the weather, site condition and infrastructure, and people problems," he says. "In our laboratory, we diagnose about 38 percent of our samples with abiotic stress. Temperature and moisture stress – extremes hot/cold and dry/wet – or some combination of both cause most of the problems."

Some abiotic stresses are site-specific, related to management practices or events at that location, says Dr. Megan Kennelly, associate professor at Kansas State University's Department of Plant Pathology. Others are more widespread, such as winter injury across a whole region, or summer decline from hot, humid conditions across a large area.

For example, 2010 was a hot, humid summer in Kansas and many other states and hot, water-saturated soils led to wide scale turf decline, Kennelly says. In contrast, 2012 was a major drought in many places, and water quantity and quality issues were a big story that year.

"In early spring we see a lot of areas are with some cold damage as the grasses are greening up," he says. "During hot, stressful summers there can be abiotic decline across large areas."

Abiotic turfgrass problems can develop into specific patches and symptoms that may mimic root diseases.

"There are numerous instances when we look at a turf sample that has symptoms that resemble a root disease such as take-all patch, pythium root rot, or Bermudagrass decline, but after examination we cannot find enough of the causal organism to conclude a disease has truly developed," Kennelly

says. "Plus we also look at the soil structure, rooting, salt accumulation and with all of that data plus a record from the golf course superintendent, we conclude that something abiotic is the main cause of the problem."

Turfgrass is a very dynamic system with an abundance of microbial activity. Most if not all common turf pathogens are present in soil samples, Kearns says, but turf managers have to make a judgment call on when the symptoms, the signs of the organism (and the amount) and environmental conditions are correct for a disease."

"The disease triangle is a fundamental concept in plant pathology that states that a virulent pathogen, a susceptible host and a conducive environment must come together in a specific point in time in order for disease to develop," Kearns says. "Thus, disease is actually a relatively rare event in nature. Since golfers demand a monoculture and certain playing conditions, golf course superintendents are required to manage their playing surfaces on the verge of death, essentially. Therefore abiotic and biotic problems plague golf course turfgrass. The key is developing a good relationship with a diagnostic lab that can help managers distinguish between abiotic and biotic problems."

If a crew member burns the grass with a pesticide or hydraulic fluid there will be an unmistakable pattern. Temperature and moisture stress, however, are often non-

## Helpful hints

Richard Buckley, coordinator of the Plant Diagnostic Laboratory at Rutgers University, provides some additional helpful hints to diagnose abiotic stress in your turf.

1. Know your pathogen so you can rule out diseases; real diseases are easy. "Who doesn't know red thread or brown patch?"
2. Know your grasses. "By understanding the agronomic requirements for the grasses you are using, it will be very clear when environmental conditions are having a negative impact."
3. Understand your site. "Nothing illustrates infrastructure problems like a little environmental stress."
4. Look for patterns. With the possible exception of pink snow mold or pythium blight, diseases don't make stripes, blocks, uniform patches, or similar sized specks over a green.
5. Recognize symptom progressions. Living organisms grow, spread and move. There is a time dynamic associated with the pathogen life cycle. Heat stress or spray burn happen, it is usually quick and often the grass will recover.

"Careful observations of your site, the weather, and your treatment effects will tell you what happened – just open up to the possibilities.....and use a professional for help," he says.

Overly wet soil conditions can lead to a multitude of other biotic and abiotic issues, such as the black layer shown here.

descript and manifest as general yellowing and thinning, both symptoms used to describe any number of diseases.

Determining the root cause of damage on putting greens or any turfgrass area can be challenging. Plant symptoms often look very similar, and a superintendent should be wary of advice coming solely from a "six-foot" (or standing height) perspective.

The first step is to ask: What is different about this green or area from others that look fine? Is there more water or is it not draining well? Was there a product misapplication? Is it shaded or tucked in the corner?

Secondly, look for patterns. Damage caused by an infectious disease is often randomly scattered across an area, and most diseases can only infect or are more aggressive on one turfgrass species (bentgrass vs. *Poa annua*) as opposed to another. Also, infectious diseases normally don't occur in straight lines, which is a stand symptom indicative of an equipment leak or chemical misapplication. Lastly, get a diagnostic visit, send or take a sample to your local turfgrass pathologist.

To determine what may be going on with your turf is to document symptoms with photos or try to see patterns. "The key to diagnosing many odd abiotic possibilities is to ask questions about what may have been done recently cultural practices, pesticide applications, weather information," Dr. Fresenburg says. "Sometimes those actions can point a finger to the cause and you can remedy the problem."

Buckley believes diagnosing abiotic stress amounts to "proving the negative." The turf should be carefully examined for disease and insect pests. Once they are ruled out, evaluate cause and effect. "What was the recent weather? Did we do anything to the grass? Is the irrigation system functioning, sprayer calibrated, mower set up right, etc. With an abiotic stress the cause and effect is usually clear if one is honest about the current conditions. Think `it was 100-degree on Tuesday, what did I miss?' or, `I you put nine products in the tank, what do I expect?'"

Diagnosing turf problems – both abiotic and biotic – can be tricky, Kennelly says. When in doubt, it is best to work with a diagnostic lab. Sign up for newsletters, blogs, and social media from your region's turf specialists who can tell you what is going on in your area.

"However, a few key pointers are to look for patterns in space and time," Kennelly says. "Diseases are more likely to start in one area and then get worse over time." Abiotic issues are more likely to be "all at once." But, there is still a lot of variation. "Think about the weather conditions and what sorts of stresses or diseases could be occurring. Consider any activities at the golf course over the past few weeks – has there been anything unusual? What has the weather been? Taking photos and notes over the time can help you keep track of when/where issues started. This can be valuable within one season and from year-to-year." **GCI**

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# WINTERKILL

## A note to golfers about this winter and its impact.

This was a tough winter for most turfgrass managers. The discussions surrounding winterkill in both cool- and to a lesser extent warm-season turfgrasses was prominent throughout the industry. Many shared their stories of death and destruction while others were happy to be able to post images of healthy greens.

Winterkill on annual bluegrass putting greens was rampant on many courses throughout the mid-Atlantic and Northern US. Even our research plots at the Valentine Turfgrass Center were pretty much a total loss. Thankfully, I didn't have any ongoing research in these areas and we hope to have them back to full capacity by the time our anthracnose trials begin in June.

The bad part about our death and destruction is that we had originally thought that we made it through with minor problems. We did exactly what we preached to all of you out there and pulled samples from various areas, placed them in a greenhouse and waited to see if anything survived. Surprisingly, we observed pretty good recovery in nearly all samples that we pulled in early March.

Unfortunately, the winter didn't want to let go and the damage had yet to be done. Despite what appeared to be relatively unharmed in March, April thaws and refreezes coupled with prolonged periods of cold weather put the final nail in the coffin. We ended up with 100 percent death. It was like an episode of Game of Thrones when Ned Stark was about to be freed only to have his head chopped off. So much hope killed with one swing of the sword.

Just like us, many of you who thought that you made it through the season in decent shape didn't come up with a contingency plan to deal with the death. This means unexpected increases in labor and budget to get the turf back in playing conditions. It also means delayed openings, reduced rounds and decreased income for the club. Based on this, members will be pushing to get things back to normal.

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For those superintendents that had to deal with (or are dealing with) dead turf, there will be nothing normal about this season. While overseeding and resodding may have taken place and the putting surfaces now look like they are in prime condition, they're likely far from it.

If you were one of the fortunate ones who got the go ahead to resod with creeping bentgrass, you will probably be in the best spot. However, you will still be dealing with very young and relatively shallow rooted turfgrass as we head into the summer.

For those that did what we did in our research plots and simply poked as many holes as possible to allow the existing Poa seed to germinate, you may be in for a struggle. These young seedlings have about 1-2 months to become as healthy as possible before the summer stress wallops its punch. There's a reason we don't open a golf course 2 months after seeding.

So what do the members and golfers need to know?

They need to know that this was one hell of a winter and you're not alone in your struggles. They need to realize that there's a reason the course

(KAMINSKI *continues on page 62)*

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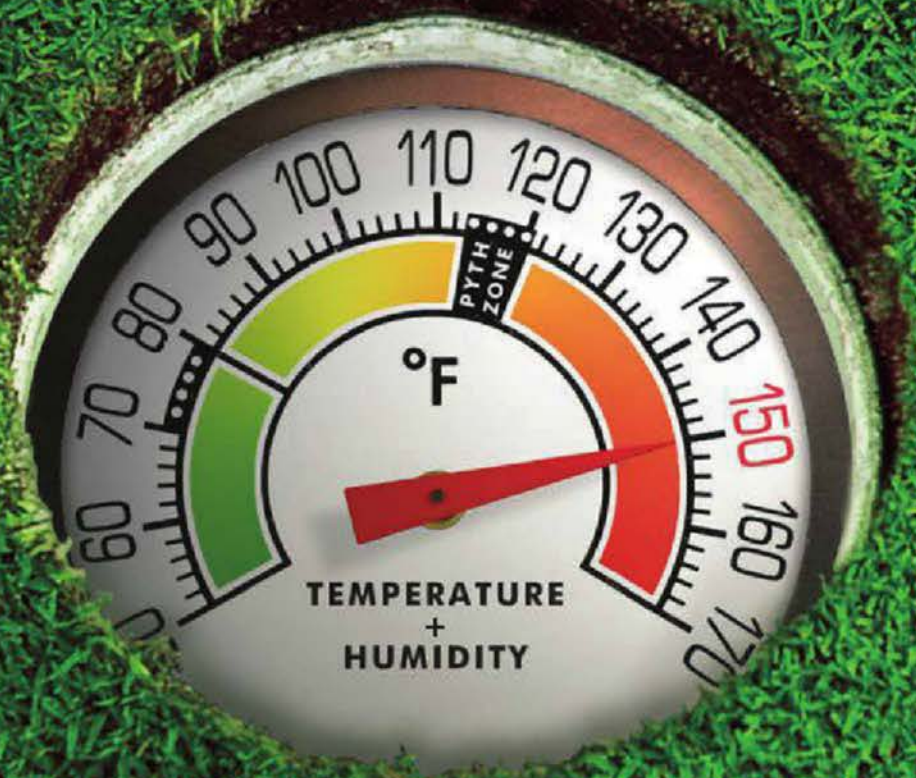


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# HELPING WITH TURF RESEARCH

## Wisconsin turf profs band together to consolidate funding resources.

I read John Kaminski's March column with great interest. I'm glad he wrote it and, for the most part, he's right on the mark. I suspect most of his academic colleagues would agree with him, too.

Funding has been an issue for as long I as I have been in the turf profession. The lack of industry financial support was the catalyst for the Wisconsin Turfgrass Association in the early 1980s. A serious turf disease was having a negative impact, especially on sod production, and a group of sod producers visited the University of Wisconsin's college of agricultural and life sciences dean for action. In a nutshell, his response was: "You'll have to help with funding."

> "...I do know that in a relatively small state in terms of population, Wisconsin turf professionals have done an excellent job in support of our land grant university and its turf program."

The WTA is an umbrella organization that covers golf turf, sod production, lawn care, sports turf, cemeteries, manufacturers, and distributors. From the beginning, there has been a broad base of support. Our success is due to our focus and hard work supporting turfgrass research at the UW-Madison, just like the dean suggested. We zero in on faculty need. In addition to membership dues, we started a field day, a winter conference and a golf fundraiser. Various turf groups now have their own events to raise money for the WTA.

We started giving scholarships and making research grants. The amount of funding wasn't large, but we had priorities in mind. We had our eyes on a really big project – to conceive, design, build and gift to the university an agricultural research station for turfgrass like most other states already had. Being the last to build a turfgrass research station allowed us to learn and build the best. Due to good timing and fortunate politics, we acquired the land we needed contiguous to the new university golf course that was underway.

Once fund raising started and was well known, we had an anonymous donor step up and match what we raised, which shortened our time frame. Before we knew it, the building was designed and The O.J. Noer Turfgrass Research and Education Facility was open and ready for business. By the way, we didn't deed the farm and all the amenities over to the state until we were completely finished. We did it all our way.

Our support of faculty has covered other areas. Over the past 25 years we've averaged half a dozen scholarships each year. The WTA has funded the first-year salary and benefit package for two new turf profs to secure their hiring. We've funded individual projects, purchased all kinds of equipment from computers and data loggers to mowers and trucksters. Equipment and soft goods manufacturers have been extremely supportive as well. Our ARS has hosted urban field days, our own WTA Turfgrass Field Day, Grandparents University and even the TPI Field Days. The Noer Facility houses our turf diagnostic lab, a development that happened only after we built the station. The WTA also funds half of the program assistant's salary.

Another big step was taken when we established a relationship with the UW Foundation. This organization helps with fundraising, manages our money and deals with legal and investment issues. The WTA now has four WTA Wisconsin Distinguished Graduate Fellowships, each one supporting a grad student. This fellowship fund gives access to the earnings of our $2 million corpus and is accessible only to turfgrass faculty for grad students. We also have a WTA Turfgrass Research Sustainability Fund in the UWF to support research requests. And we are initiating a legacy endowment fund in the UWF to help industry people with estate planning, legacy gifting and similar needs. This fund does not allow any invasion of the principal; only the earnings support research.

To John's point about decreased GCSAA research funding, I am guessing GCSAA dues and income are at the point of what traffic will bear, and I doubt they can help it.

But I do know in a relatively small state, Wisconsin turf professionals have done an excellent job in support of our land grant university and its turf program. Our mission is to keep it going; after all, we are only helping to help ourselves. **GCI**