The benefits are obvious, stimulating natural plant defenses can lead to reductions in the amount of fungicide introduced into the environment while maintaining acceptable levels of disease suppression. However, the reality is more complex. We have seen effective management of several diseases using Daconil Action® in our research trials with repeated Daconil Action® applications **(Figure 2)**, but have heard some disappointing reports from the field if the product is not used repeatedly as part of a program. Civitas®, while giving excellent green color, has performed poorly as a fungicide on its own when applied to manage snow mold and should be used as part of a mixture of different active ingredients.

Syngenta has been busy

You have likely been hearing a lot from your friendly Syngenta sales representative in the past few months, and for good reason. Syngenta has brought 3 new fungicides to the golf turf market this year. Secure® (fluazinam) has been around in the agriculture world for many years, but is just now making its way into the turf market and has the potential to become a key component of many fungicide programs for years to come. The main benefit of this product is that it's a contact, multi-site mode of action fungicide that has performed well against a broad range of pathogens **(Figure 3).** If this sounds similar to chlorothalonil, that's because it is, and it has the potential to replace chlorothalonil in many applications and lessen the concern about reaching the annual chlorothalonil maximums. Appear® (potassium phosphite) can basically be thought of as Syngenta's response to Chipco Signature, and is designed to be used in a similar manner. Namely, that it will provide some fungicidal activity against certain diseases (ie Pythium) but that it's primarily intended to be used repeatedly as part of a program on putting greens to reduce summer stresses. Briskway® (difenoconazole + azoxystrobin) contains a new DMI fungicide (along with the active ingredient in Heritage®), and can be used against a broad range of turfgrass pathogens. But the primary advancement with difenoconazole is the near absence of growth regulation, which allows its use even in stressful summer conditions.

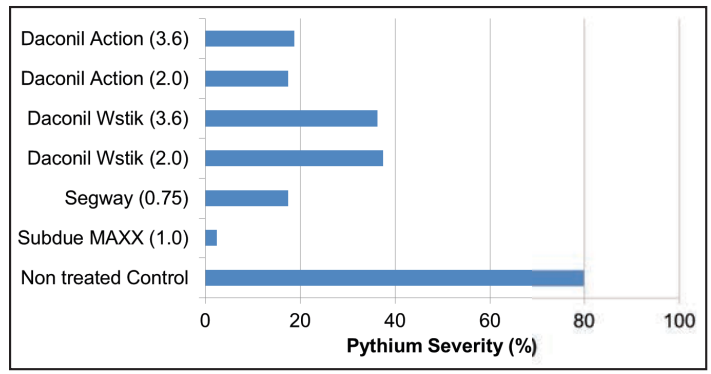


Figure 2: Pythium blight trial conducted on juvenile perennial ryegrass at the OJ Noer Turfgrass Research Facility in Madison, WI in 2011. Note the increased level of Pythium suppression with Daconil Action® versus Daconil WeatherStik®, presumably due to the effects of acibenzolar-S-methyl in Daconil Action®.

This product will likely be more popular in the transition zone, the mid-Atlantic, and the northeast, but may become popular around the Midwest if summers like 2012 become more consistent.

BASF's irons in the fire

BASF is also bringing some new fungicides to the golf turf market in the near future. Encartis® is a fungicide pre-mixture that combines boscalid (Emerald®) with chlorothalonil, expanding the spectrum of disease control beyond the dollar spot that Emerald® alone could manage **(Figure 4)**. To my knowledge, this product has not yet been registered by the EPA for use on turfgrass, but registration is expected soon. BASF also has plans to bring a new fungicide molecule from the SDHI (succinate dehydrogenase inhibitor) class to the golf turf market. This fungicide, called fluxapyroxad (Xzemplar®), is similar to Emerald® in some respects but will control a broader range of fungal diseases. Xzemplar is not currently registered for use on turfgrass, but registration is expected late in 2013 with a possible launch in 2014.

Bayer, Cleary, and Quali-pro aren't resting either

Though not releasing a new fungicide this year, Bayer recently started a new 'Healthy Turf, Healthy Tomorrow' initiative. This initiative will focus on plant-health related research through significant donations to the Environmental Institute for Golf. Bayer was one of the original plant defense innovators with the release of their StressGard® formulation in Chipco Signature® in the 1990's, which has since been included in many of their other recent fungicide releases including Tartan®, Triton FLO®, and Interface®.

Cleary Chemical was recently acquired by Nufarm, which brings Cleary's broad fungicide portfolio into concert with the large herbicide and insecticide business that Nufarm already has. Cleary is working on several new fungicides that should be coming to market in the coming years that will likely expand on the successful launch of Torque® a couple years ago.

Quali-pro has also recently introduced a new fungicide, Enclave®, to the turfgrass market. While this is a pre-mixture of previous active ingredients (chlorothalonil, iprodione, tebuconazole, thiophanate-methyl), to my knowledge it is the first 4-way pre-mixture on the turfgrass market. With 4 active ingredients in one product, if you see any disease except for Pythium after applying this product you did something wrong. The race for a 5-way pre-mixture begins now.

How does all this affect me?

The effect of these new fungicides will not likely be measured immediately. I highly recommend that superintendents be skeptical at first, applying one application here and there to see how it affects the turf and suppresses disease at their course. All of the products listed here have been tested in our UW Fungicide Research Reports in the past few years (http://www.tdl.wisc.edu/research.php), and I urge you to peruse these reports yourself. One or two of these products may become mainstays in your fungicide program for years to come, while others may struggle to find a niche and replace older, effective products. Which ones thrive and which ones fall by the wayside will depend on a number of factors including efficacy, price, technical support, and ease of use. Please don't hesitate to contact me (plkoch@wisc.edu, 608-576-2673) if you have any questions about these or other products and how they fit into your program.

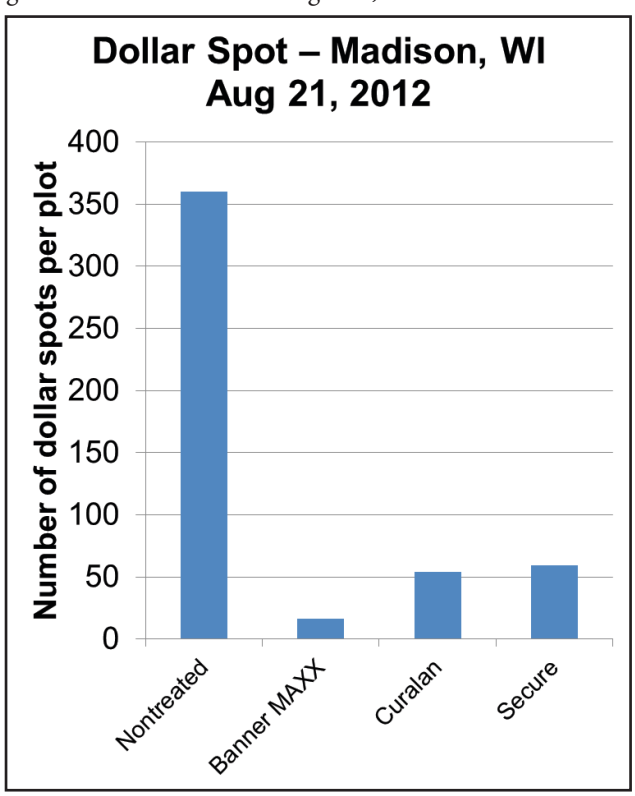


Figure 3: Small sample of treatments from a dollar spot trial conducted at the OJ Noer Turfgrass Research Facility in Madison, WI in 2012. Note the significant reductions in dollar spot seen with Secure applied on a 14 day interval despite extreme disease pressures. Because this is a contact fungicide, decreasing the reapplication interval or tank-mixing with a penetrant fungicide would likely have increased the level of suppression.

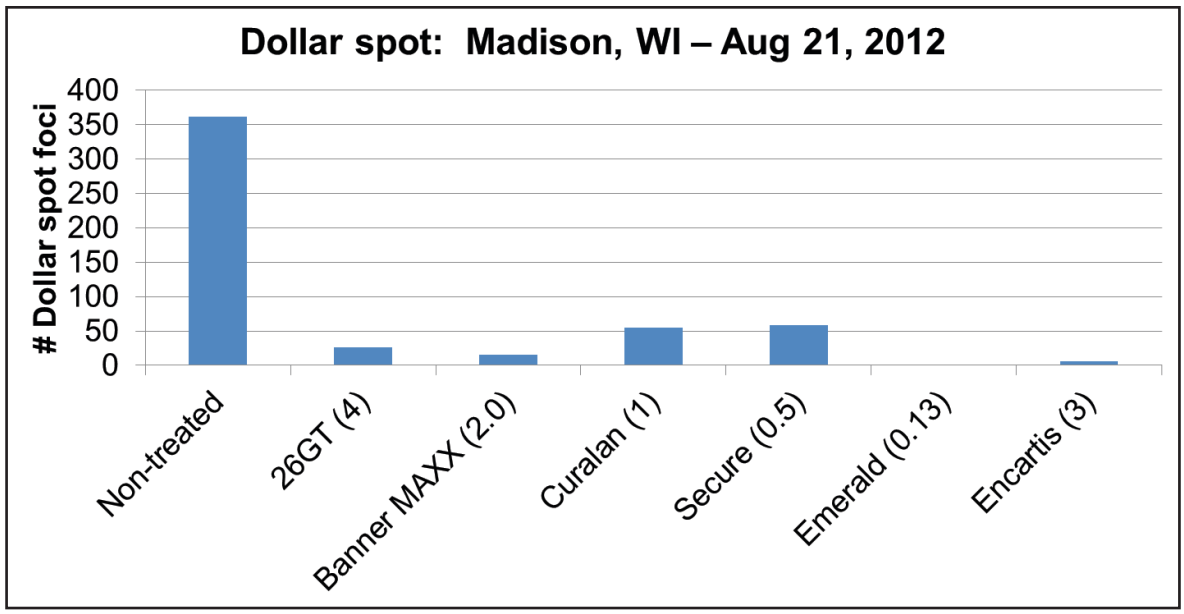


Figure 4: Small sample of treatments from a dollar spot trial conducted at the OJ Noer Turfgrass Research Facility in Madison, WI in 2012. Note the near absence of dollar spot observed in plots treated with both Encartis® and Emerald® (which both contain boscalid) despite heavy disease pressure.

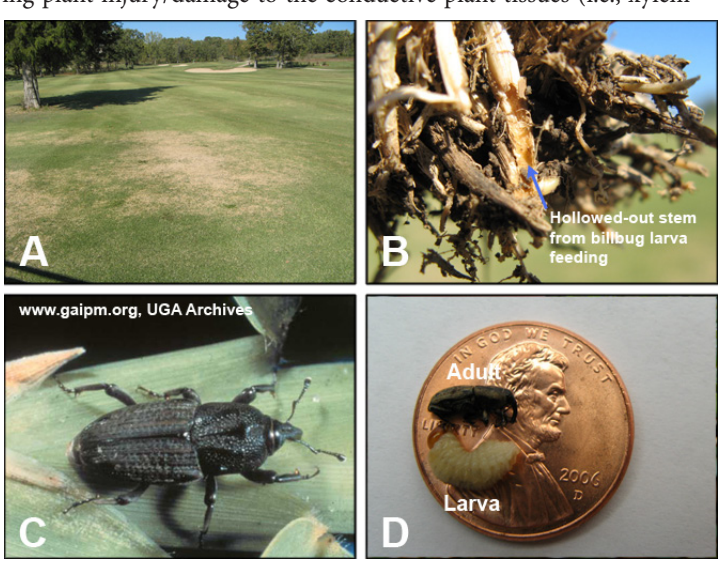
Billbugs?

By Dr. R Chris Williamson, Department of Entomology, University of Wisconsin-Madison

Probably not anywhere on your radar, but billbugs very well should be an insect pest for concern. Billbugs are considered one of the most commonly misdiagnosed turf pests! Billbug damage is often mistaken for drought, disease, heat stress or damage caused by other turfgrass insect pests including white grubs, sod webworms and chinch bugs. There are several billbug species that occur in the United States, the bluegrass billbug, Sphenophorus parvulus, and the lesser billbug, S. minimus, are the two important billbugs that can be found in cool-season turfgrass. Of these, the bluegrass billbug is the more common species.

Adult billbugs are similar to most other weevils (snout beetles) in appearance, thus they have a characteristic and unique elongated snout (mouthpart) and hardened wing covers. Bluegrass billbug adults are about 5/16 inch long and the lesser billbug is slightly smaller (1/4 inch long). Unlike other white grubs such as Japanese beetle, billbug larvae (grubs) do not have legs and they are much smaller, only about 0.05 inch long while Japanese beetle larvae are about 0.4-1.3 inches long. The bluegrass and lesser billbugs prefer Kentucky bluegrass, perennial ryegrass as well as certain fescue species over most other cool season turfgrasses.

There is typically only one generation per year of billbugs, they overwinter as adults in the turf and surrounding areas. Billbug adults begin laying eggs in the leaf sheaths of turfgrass in the spring (i.e., May), the eggs hatch in 10-14 days. The larval stage is the damaging life stage, 1st instar larvae burrow up and down the leaf sheath causing plant injury/damage to the conductive plant tissues (i.e., xylem and phloem) as well as the apical meristem (crown).



A. Drought like damage from Billbug Larvae. B. The turf pulls up easily when tugged and small legless larvae are present. C. The adult Billbug does not feed on turf. D. Both adults and larvae are small and often unnoticed. **(Photo from University of Arkansas Turfgrass Science, Turfgrass Tips, Nov 1, 2007)**

Prior to reaching physiological maturity, billbug larvae chew their way out of the turfgrass plant to feed and cause damage to roots before pupating (transforming into an adult) sometime in August. Larval feeding damage typically occurs in June and July. After pupation (i.e., August – September), adult billbugs begin to emerge to feed and prepare for overwintering, initially they are typically reddish-brown in color, but eventually turn slate. Several options for managing billbugs exit: 1) cultural control; 2) plant resistance; and chemical control (insecticides). Cultural control of billbugs consists of providing adequate fertility and irrigation to minimize or mask billbug damage.

The use of endophyte (fungi) enhanced turfgrasses including perennial ryegrass and tall fescue can provide plant resistance due to the toxic properties of the endophyte that kill billbug larvae as they feed on the endophyte enhanced turfgrass. Research has shown that stands of turfgrass that contain 40-50% endophyte infections keep damaging populations of billbugs in check. Finally, there are three chemical (insecticide) approaches to managing billbugs, they include: 1) Larval preventative, 2) Adult curative and 3) Larval curative. Of these, larval preventative and adult curative are the most effective, the larval curative management strategy does not prevent turf damage as billbug larvae have already caused turf damage.

Larval preventive insecticide treatments are most effective when applied in late April to mid-May to ensure that the insecticide can be readily absorbed and available when billbug larvae eggs hatch and larvae begin feeding within the leaf sheath in late May to early-June. To ensure maximum insecticide performance of larval preventative insecticide treatments, be sure to apply post-treatment irrigation to move the insecticide into the soil so that it can be absorbed the turfgrass roots and translocated into the leaf sheath where billbug larvae feed. It is hypothesized that this larval preventive insecticide treatment application may also kill some overwintered adults, however this has not been confirmed.

The second effective billbug management strategy is to apply an adult curative insecticide to active adults in the spring, typically in late April to early-May or at the first sign of active adult billbugs. If this billbug management strategy is used, do not apply post-treatment irrigation. To assist in the proper timing of an adult curative insecticide application, merely monitor or observe paved surfaces such as sidewalks and driveways for the presence of billbug adults.

Determining bluegrass and lesser billbug larval attack is fairly simple, use the "tug-test" to confirm the presence of billbug larvae. To carry out the tug-test, simply grab several of the affected leaf sheaths and tug upward. If the turf is or was damaged by billbug larvae, the leaf sheaths will break off easily just below the thatch level and the broken leaf sheaths will be packed with a fine sawdust-like material. This material is commonly referred to as frass or billbug fecal matter. Unfortunately, at this point, the damage is done and no insecticide treatment application will resolve the turf damage issue. Remember, when using pesticides, ALWAYS read and follow the label directions!

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Surviving An Icy Winter

By Brad T. DeBels, Turfgrass Diagnostic Lab Manager, O.J. Noer Turfgrass Research and Education Facility

Editors Note: Mr. Brad DeBels is a PhD student under Dr. Soldat. His research is based on water conservation and quality for turfgrass. This article is eligible for the Monroe Miller Literary Scholarship awarded to the best student written article each year.

For those of you that had the displeasure of dealing with the icy winter of 2005, you may remember the significant turf loss that ensued that spring. The discussions that arose initiated an article written by Dr. John Stier, now with the University of Tennessee, that discussed types of ice formation and damage. Since that year ice damage has been of minimal concern in the region, until this winter. As this article is being written I look out of the O.J. Noer windows and see acres of ice cover, but yet the extent of the damage will be unknown until spring. With that I think it is relevant to revisit the implications of ice cover on turf and things we may have learned.

Wisconsin Weather…Yikes!

The month of January was mildly rolling along when the Wisconsin weather pattern displayed its true colors. An arctic blast with high temperatures rarely in the double digits starting on the 20th of January, followed by a record high of 54°F with nearly 2 inches of rain on January 29th, trailed by once again freezing temperatures and more than 6 inches of snow. Even with the high temperatures, much of the soil remained frozen other than the top inch or less, leaving us with significant flooding of low lying areas and eventual ice cover and encasement of much of our landscape. So, how much should we worry about spring turf recovery and what affects the potential for regrowth?

Ice Cover

Many of our cool season grasses are relatively invulnerable to ice damage, but not all ice cover poses the same risks. Two major forms of ice damage turf; direct ice cover and ice encasement. Direct ice cover injury results from ice acting as a barrier to gas exchange between the turf tissue and atmosphere. Turf kill will result from oxygen suffocation (anoxia) or accumulation of toxic gases such as carbon dioxide, methane and cyanide between the ice layer and turf. These gases come from oxidation of living tissue, thatch, soil organic matter and/or respiration of low temperature fungi.

Unfortunately there has not been extensive research conducted on ice cover in the last few decades, likely because ice damage is rare in the northern part of the United States, but much of the U.S. doesn't even see snowfall. Annual bluegrass has been observed to survive 60 days, Kentucky bluegrass 75 days, and creeping bentgrass more than 90 days under continual ice cover (Beard, 1964). Luckily here in Wisconsin, if we see ice cover, we rarely see more than two months of consistent ice cover. Because the damage is attributed to gas exchange, it is important to consider the type of ice as well. Clear, dense ice allows for little if any gas diffusion, whereas cloudy, low density ice will allow for more gas diffusion prolonging turf survival.

Ice Encasement

The second type of ice damage is caused by ice encasement. Ice encasement is most easily defined as a situation in which the soil becomes frozen when saturated, either after a rainfall or freeze/thaw cycles, with a significant surface ice layer. This removes oxygen from the soil which is needed for plant growth, even in winter, and may also cause unneeded crown hydration. The elevated crown hydration level increases the freezing and killing temperature of the plant promoting the formation of intra- or intercellular ice crystals.

Ice damage, spring 2004. Photo courtesy of Dr. Paul Koch.

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Intracellular ice crystal formation (ice flashing) is rare, but occurs when temperatures fall rapidly and ice crystals form in cells and destroy plant membranes causing rapid death. Intercellular ice crystal formation is when ice forms between the cells and draws water out of cell, due to the lower vapor pressure of ice, and the cell desiccates.

In a field study, Kentucky bluegrass was completely dead with no spring regrowth after 6 days of being frozen under a compacted slush layer and creeping bentgrass had 20% crown death (Beard, 1965). In a laboratory study, Tompkins et al. (2004) found living tissue to remain after 75 days of ice encasement of annual bluegrass and after 150 days for creeping bentgrass at 25 °F. The Tomkins et al. study shows a much longer survival period of turfgrass under ice encasement conditions, but laboratory studies often have difficulty simulating the fluctuating air temperatures of winter which may reduce cold hardiness. It is also notable that the lab study occurred at 25°F, a relatively high temperature when considering cellular ice crystal formation during Wisconsin winters. Either way, this demonstrates the variability of cell death due to ice formation and cover.

Ice Prevention and Removal

While we can examine data and select more cold tolerant species, there is often little we can do to prevent ice damage aside from constructing surfaces with optimal surface drainage to allow for rapid removal of winter rainfall and snow melt. The actual removal of ice after formation is much more problematic. I have seen sand or fertilizer being applied to speed ice melt, where the low albedo material absorbs thermal energy. Removal via aerator and shovels and the plowing of greens in late winter to expose ice to sunlight may also work. Possibly the best advancement in recent years have been related to putting green covers that are impermeable and/or have a thin insulated layer which allows for gas exchange.

With any tactic, we must consider the effects of our remedy on exceedingly early spring green up and possible damage during ice removal. Preparing our turf for winter by proper mowing, fertilization, drainage, shade management, topdressing and aeration practices can all promote cold hardiness of turf, but occasionally Mother Nature will prove that much of this management is futile. We must realize many of our turfgrass plants are extremely hardy and rarely do we see conditions that require extraordinary means to remove ice. Understanding the type of ice damage possible and resiliency of your turf is important, but a few prayers for warm weather may also go a long way.

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Tom Harrison Receives Distinguished Service Award

By David Brandenburg, Golf Course Manager, Rolling Meadows Golf Course

"An exceptional person who has made exceptional contributions" is how WGCSA Historian Monroe Miller chose to describe his longtime friend and colleague Tom Harrison as he listed the many contributions he has given to his community, his family and his industry. Harrison was a leader who did so many things without wanting recognition.

Tom spent a career getting things done in a professional manner as a leader for the Wisconsin Turfgrass Association, the Wisconsin Golf Course Superintendents Association and as the Golf Course Superintendent at Maple Bluff Country Club.

Tom entered the golf industry while at McFarland High School working at Nakoma Country Club. After graduation Harrison enrolled at UW-Madison as an engineering student despite enjoying his time at the golf course. As a freshman Tom was the last man cut by the basketball team and was recruited to row for the crew team before he left the Field House.

With the Vietnam war going on in the mid 1960's it was pretty much enlist or be drafted and Tom wanted to choose what he did so he enlisted in the Navy. Nearing the end of his enlistment Tom decided what he wanted was a career at the golf course and in 1968 he headed to Maple Bluff Country Club to work as an assistant to Bill Eckert. In 1975 he took over for Bill and now after 44 years maintaining the historic golf course he has retired.

Tom served the members of the WGCSA as a board member but is better known as a founder and leader for the Wisconsin Turfgrass Association. Tom has served the WTA as a board member for over 30 years and as president from 1983-1986. Harrison was instrumental in building the O.J. Noer Turfgrass Research and Education Facility near Verona and giving it to the University of Wisconsin. Tom was there every step from buying the land, designing the layout and building the facility.

Top Left: Thomas Harrison receives the Distinguished Service Plaque from WGCSA President Chad Harrington.

Top Right: Dr. Gayle Worf, Dr. Dan Mohr and Dr. Robert Newman receive keys to a new vehicle from WTA President Tom Harrison in 1985.

1993 25-Year Members Jeff Bottensek, Wayne Otto, Larry Karel and Tom Harrison.