

//MELTDOWN

# Winterkill in the crosshairs

## *Cultural considerations for preparing greens for winter*

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*Editor's note: This is the first of two articles by the authors on turf survival during winter.*

**T**he 2013-2014 winter has gone down in the record books as one of the worst. Depending on your location, conditions may have included severe and prolonged freezing temperatures (aka: polar vortex), temperature fluctuations above and below freezing, excessive rainfall followed by freezing temperatures

and significant snowfall events from December through March.

With this in mind, it is important to understand the multitude of factors contributing to winter injury and the cultural practices that can be implemented to minimize damage.

The term "winter injury" is a catchall term that refers to damage caused by a number of different factors including crown hydration, anoxia and gas buildup, desiccation, low temperature fungi and freezing temperatures. These

factors may act alone or in concert causing damage to plants, and are collectively recognized as winterkill. Regardless of the type or number of stresses affecting the plant, the occurrence of winterkill is directly attributed to death of the turfgrass crown.

Management strategies should be implemented throughout the year to promote crown survival during and following winter months. This involves minimizing or eliminating conditions that would favor the development of

PHOTO 1



An ice melting study at the University of Minnesota's Turfgrass Research, Outreach and Education Center, conducted this last winter. These manufactured ice blocks were treated with 20 different salt and solar absorption products to evaluate ice melting potential. More detail on this study can be found at: [www.turf.umn.edu](http://www.turf.umn.edu).

PHOTO BY: ANDREW HOLLMAN

stresses such as crown hydration and anoxia. Consequently, preparing for winter injury should be considered a year-long process that encompasses a number of different cultural practices to promote turfgrass health.

### GETTING WINTER READY

Winter hardiness of turfgrasses is achieved through the process of cold acclimation, which is induced by decreases in temperature and light during the fall. During this period of time, turfgrass plants undergo physiological and metabolic changes that allow them to become more tolerant to winter stresses. The process of cold acclimation is influenced by plant genetics (such as the species or cultivar) in combination with environmental conditions (such as temperature and moisture).

Along with cold acclimation, temperature fluctuations during winter and early spring months (deacclimation) can also influence the winter injury potential of the turfgrass. Largely, cold acclimation capacity and resistance to early cold deacclimation is controlled by genetics; however, there is potential to increase both of these factors through management strategies to ultimately reduce overall winter injury.

Because of the high degree of species variability that exists on putting greens, turfgrass species becomes the major factor influencing winter injury. For example, creeping bentgrass has excellent winter hardiness compared to annual bluegrass.

Research has shown that differences in winter injury potential between these two species is associated with enhanced cold acclimation capacity of creeping bentgrass along with increased susceptibility of annual bluegrass to early cold deacclimation (Thompkins et al., 2000, 2004; Hoffman et al., 2014). Therefore, one strategy to minimize winter damage would be to promote creeping bentgrass and reduce annual bluegrass

PHOTO 2



Sod cutters are useful in opening up channels for water flow off putting surfaces prior to winter. Water will often back up at the green/collar interface, therefore extending these channels through the collar and into the green can be important.

populations.

In some situations this may not be an option. In addition, creeping bentgrass may still be susceptible to winter injury, depending on both plant and environmental factors. Consequently, management of annual bluegrass/creeping bentgrass golf greens should focus on promoting healthy turfgrass plants throughout the year while minimizing conditions that favor the potential for winter injury.

So let's look at a few of the major winter stresses, along with management strategies to prepare greens for winter.

### ICE, ICE, BABY

Crown hydration and damage from ice cover are two of the most devastating causes of winter injury on putting greens every year. Crown hydration occurs when temperatures increase, causing plants to absorb water, and results in winter injury if

followed by subfreezing temperatures. As a consequence, cells rupture due to the formation of ice crystals and this is lethal for the plant. Damage may also be associated with ice formation outside of cells, causing water to move out of the cells and can cause severe dehydration and/or death of the turfgrass.

Ice cover can also be a contributor to crown hydration as ice melts and then refreezes. In addition, non-porous ice can cause anoxia and/or buildup of toxic gases, mainly CO<sub>2</sub>, and has been shown to be more injurious to annual bluegrass compared to creeping bentgrass.

Tompkins et al. (2000, 2004) studied the impact of ice encasement, ice cover and snow cover on annual bluegrass in a growth chamber and in the field. Annual bluegrass plants did not survive 90 days of ice encasement in

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PHOTO 3



A five-inch auger bit being drilled three feet deep by staff at Medina (Minn.) G&CC to promote water infiltration in swales on native soil greens with no drainage. Channels are back-filled with pea gravel.

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the growth chamber, whereas creeping bentgrass survived for 150 days. In the field, death of annual bluegrass plants was observed at 75 days of ice cover with damage to creeping bentgrass detected following 90 days of ice cover. These interspecific differences in winter injury associated with crown hydration and ice cover may primarily be associated with plant genetics; however, reducing overall moisture on greens prior and during winter may help reduce the incidence of both these stresses.

Golf courses dealing with extended periods of ice cover have lessened the damage by removing or melting the ice. A current study being conducted at the University of Minnesota and Michigan State University is evaluating the ice

melting potential of several standard salts, specific ice melt products and solar absorption materials. The greatest melt followed the use of black solar absorption materials (Photo 1); black substances increased surface temperatures by up to seven degrees F. Products included in the solar absorption treatments were: Milorganite (6-2-0), Sustane (5-2-10), dyed black sand, Top Cut biosolids and BioDac (paper by-product). Phytotoxicity of these products to putting greens is also being evaluated. A more detailed explanation of this study can be found on the University of Minnesota's Turfgrass Science website ([www.turf.umn.edu](http://www.turf.umn.edu)).

### LET IT DRAIN

While sometimes impossible to predict and manage, surface and subsurface

drainage are important for reducing injury from crown hydration or ice cover. Surface drainage is based on the architecture of the green. Low-lying areas that hold water on the surface have the greatest potential for damage and moving water off of putting surfaces during the spring transition will have the biggest impact on survivability. As such, creating pathways and channels for water to travel is important for reducing damage (Photo 2). These areas should be established prior to winter to allow drainage as spring temperatures increase.

Swales on greens often drain poorly, which can result in excess surface moisture. Minimizing damage in these areas is much more difficult, but can be promoted by creating openings on the surface in these swales. Deep tine and core-aeration prior to winter help to alleviate damage by standing water in the spring, but the trade-off can be increased desiccation in winters that lack snow cover or in areas prone to drying.

Putting greens built on natural soils with minimal drainage will benefit from augering channels to improve water flow in these swales (Photo 3) and should be filled with pea gravel or other porous materials.

### MORE TO CONSIDER

Another important component in improving winter survivability is management of thatch and organic matter. On putting greens with thatch levels exceeding 0.25 inches, crowns may be exposed to fluctuating air temperatures during winter months. In comparison, crowns deeper in the soil profile are buffered against such rapid and sometimes extreme temperature changes. Excessive thatch and organic matter also hold moisture at the surface, leading to winter injury issues associated with crown hydration, ice cover and the snow mold pathogens.

Regular, frequent topdressing of sand-based root zones is required

to reduce thatch and organic matter buildup. Sand chosen for topdressing should have a consistent particle size with the existing root zone to minimize layering. For native soil putting greens, it is practical to build up a profile of sand through several years of topdressing, and from a winter injury standpoint this is almost always an improvement.

Plant growth regulators, wetting agents and other specialty turf products all have their place when preparing putting greens for winter. Generally speaking, products that promote healthy turf throughout the growing season will also be beneficial for the plants during the cold acclimation process. No one program works for every superintendent due to site specifics and climatic variation. With that in mind, be sure to use only those products you are comfortable with and have proven successful for you in the past. Test strips are useful for evaluating new products, and untreated areas for justifying current ones.

Wetting agents are more commonly being applied in the late-fall prior to irrigation blowout. The benefits of this type of application have not yet been evaluated with research, but considering that a majority of our winter injury issues are moisture related, this is a topic worth investigating. Hydrophobic sands suffering from desiccation over winter months can potentially benefit from a late season wetting agent application, as will poorly infiltrating root zones. Adequate movement of the wetting agent into the root zone through irrigation or precipitation is necessary for this application to be successful. This research is ongoing and results will be available soon.

### A HOLISTIC APPROACH

A strong focus on the basics of putting green management is important for promoting survivability of both annual bluegrass and creeping bentgrass. Dr.

James Beard may have said it best, "Cultural practices should ensure that the turf is healthy, disease-free, and well rooted as the winter season approaches," (Beard, 1973). We have learned a lot about the physiology of winter injury since then, but our recommendations remain the same. Balanced fertility, proper mowing heights, sharp reels and irrigation to promote rooting depth are just a handful of practices, in addition to what was already discussed, that need to become second nature in your management programs.

Winter injury of turfgrass is a complex issue that should be considered with a holistic approach. This article focused heavily on the types of damage that can occur over the winter months, as the specific type of winter injury will dictate management practices that should follow. No matter what type of

winter injury you are dealing with, two main points hold true: 1) healthy turf is better able to withstand the stresses of winter, and 2) mother nature rules all. Remember these points as you prepare your putting greens for winter this year.

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