Covering Up for Winter

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Last winter's dry, open conditions caused putting green death in many portions of the upper Midwest. Most affected were those putting greens constructed with a sand-based rootzone, in an elevated area, and/or with a significant proportion of annual bluegrass (*Poa annua*). In some cases creeping bentgrass also died.

Why turf dies in the winter

Winterkill is a generic term that describes any type of turf injury which occurs during the winter. In reality, winterkill can be boiled down to these causes: fungi (e.g., snow molds), low temperature kill, toxic gases, and desiccation. Direct low temperature kill is rare and occurs only when the crown temperature of the plant is exposed to some critical temperature: for creeping bentgrass, that is usually less than -18°F. Long-term impermeable ice cover may result in the buildup of toxic gases such as CO_2, though this condition also is rare as creeping bentgrass and Kentucky bluegrass may withstand ice cover for 150 days. Annual bluegrass is less tolerant, with damage possible after 60 days (Beard, 2002).

In Wisconsin the most likely cause of winterkill outside of snow molds is desiccation. Desiccation injury is most severe in years when there is insufficient snow to keep the ground covered. It is most likely to occur following a dry autumn (such as in 2002 and 2003) and/or in sand based root zones, which have a low capacity for retaining plant available moisture.

Turfgrasses survive through the winter by entering a state of dormancy similar to a bear or squirrel's hibernation. Metabolism slows but does not stop. Energy for maintaining basic cellular functions comes from carbohydrates stored in the shoots and crown. During exposed winter conditions it is not uncommon for the shoots and leaves to die, effectively shutting off the crown's access to stored carbohydrates from that source. Shoots and leaves can turn brown because sunlight continuously degrades chlorophyll and low winter temperatures prevent production of new chlorophyll molecules. If conditions aren't too severe the crown survives and produces new shoots in the spring. Shoots and leaves may also turn brown due to desiccation, though, which can occur even when the soil is frozen.

Wind moving across a living turf in frozen soil removes water vapor from the leaves. When only the soil surface is frozen the turf roots may continue to absorb moisture from the soil below to replenish moisture lost from the leaves. Overall, moisture lost from leaves when the temperature is below 40°F is significantly less than during warmer temperatures because the plants are not actively growing and use less moisture. Once the soil root zone freezes, though, roots cannot replace the lost plant moisture. In other cases the soil moisture simply drops below the permanent wilting point due to constant evaporative loss. Leaves and shoots die when either of these conditions occur.

While the dead foliage will buffer evaporative losses from the soil and/or plant crowns, extended periods of exposure may desiccate plant crowns. Since the plant crown contains the axillary buds for both new shoots and new root growth, a dead crown results in a dead plant. Too many dead crowns in an area causes a noticeably thin or completely dead putting green. Given similar root zones, elevations, and other condi-

tions, putting greens are more susceptible than tees or fairways due to the relatively small amount of foliage that can buffer evaporative soil moisture loss.

What can be done to prevent winter desiccation? Hope for snow cover! If that fails, or one doesn't want to chance it, use some type of turf cover.

Topdressing can be beneficial

Historically superintendents used a thick layer of topdressing applied at the end of the growing season to insulate the turf. Some superintendents still rely on this method. A thick layer of topdressing which buries the majority of the foliage prevents desiccation by blocking leaf exposure to the air. Since sand is relatively porous and retains little water, it heats up quickly in the spring which in turn initiates new shoot and root production from the crowns. Heavy sand topdressing may also help prevent traffic damage from early season golfers. Potential problems include expense, low turf density in the spring, and lack of ability to control late winter/early spring snow mold pressure on turf crowns.

Synthetic turf covers

Synthetic turf covers offer another option and have become quite popular. Many types exist from several manufacturers. One of the most popular is the Evergreen™ cover. An Iowa State University study this past winter at Veenker Memorial Golf Course showed the Evergreen™ cover significantly enhanced spring turf quality compared to uncovered turf (Table 1). Turf under continuous snow cover had ratings equal to turf covered with an Evergreen™ cover. The Evergreen™ cover is a woven polyethylene product and has all of the desirable features in a cover designed to prevent winter desiccation. Several other types of covers have similar features and may work as well as the Evergreen™ cover. Some other types may include spun polyethylene products and Typar, a polypropylene geotextile.

Desirable attributes in a winter cover include translucence which allow some light to penetrate through to the surface. Transparent plastic covers may allow too much light through which heats the soil and may encourage fungal or even plant growth at undesirable times. The material should be porous to allow a limited amount of air exchange, though in some cases an impermeable cover may also work. For ease of use, the material should be lightweight and able to dry quickly. Reusability is important as the upfront cost to purchase a new cover can be significant. Covers can last for years if treated by the manu-

Table 1. Effect of synthetic and ice turf covers on quality of putting green turf. Turf was rated on a 1 to 9 scale with 9 equal to ideal turf and 6 equal to acceptable quality (adapted from Minner et al., 2003).

	Creeping bentgrass		Annual bluegrass	
Simulated winter conditions	**26 March**	**30 April**	**March 26**	**30 April**
Dry/open	2.7	5.0	3.3	6.0
Wet	4.0	6.0	4.0	6.3
Continuous ice	2.7	4.7	2.3	5.7
Continuous snow	5.0	6.7	5.0	6.7
Evergreen™ cover	4.0	6.7	4.0	6.3
LSD (0.05)	0.76	0.70	0.84	NS

NS = not statistically significant at probability < 0.05.

facturer to resist UV light and mildew deterioration and properly stored. In certain situations these covers may also be used to enhance germination during establishment or to stimulate early spring greenup.

Using a cover

Turf covers should be placed on the turf after growth has stopped for the year. Apply a snow mold protective fungicide a day or two before covering the turf. If possible, wait until the ground is frozen as this will reduce the chance for a temporary soil temperature increase which may promote fungal and/or turf growth. Do not attempt to place a cover during high winds (above 10 mph) because the force of the wind will make the cover act as a sail: I've seen large covers being blown by the wind drag people across the turf. Secure the cover using turf staples available from the manufacturer or distributor. It is best to turn the edges under for 1 to 2 inches then staple through this double layer. Place staples 3 to 5 feet apart. Turning the edges under and properly securing the cover with staples will prevent strong winds from getting underneath the cover and blowing it off the turf. Try to avoid overlapping covers in high profile areas such as the middle of a putting green as this can affect spring greenup. Covers are available in different shapes and sizes and can be customized to fit individual greens.

Remove covers in late winter before greenup occurs. This will prevent succulent growth which will be especially prone to low temperature kill if temperatures decrease sharply even for a short period. In certain situations it may be desirable to leave the covers on to promote early spring greenup, but risks include low temperature injury and fungal diseases. It is not unheard of for Pythium blight, normally a mid-summer foliar disease, to kill turf in early spring when it is covered with a synthetic blanket. If covers are used to enhance early spring germination or spring greenup, be prepared with sufficient crew members to remove covers during the day when sunny or high temperature conditions are likely. Replace the covers at night when below-freezing temperatures are expected.

Make sure the cover is clean and dry before folding for storage. Place in a marked bag or otherwise identify the cover if specific covers are intended for use on a specific green.

Conclusion

Heavy sand topdressing or synthetic turf covers can help prevent winter desiccation. Covers differ in their composition and effectiveness, so make sure the cover you use can deliver the qualities you need. Ask the manufacturer or distributor for names of other customers so you can check with them before you buy a cover with which you are unfamiliar. Proper use of covers can be tricky because of potentially enhanced diseases and decreased low temperature tolerance of the turf in the spring, so get them off the green early.

Literature Cited

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