Buttoning Up for Winter

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The cooler days and nights of autumn often bring welcome relief to golf course turf after several months of high temperatures and/or disease pressure. Turf plants start growing better because the cool night temperatures reduce respiration rates. The moderate day time temperatures encourage abundant photosynthesis which is important for producing sugars the plants will store to use for respiration during the winter and renewed growth in the spring. Superintendents take advantage of these conditions to improve the overall health and quality of the turf in preparation for next year.

Follow primary cultural practices

Mowing. All grasses have their optimal mowing heights. Most cultivars of creeping bentgrass perform best between 0.2 and 0.5 inch height of cut, though a few of the newer varieties tolerate heights of 0.125 inch or so quite well. Proper height of cut is important to optimize the leaf area index (LAI), which is a measure of the surface area of leaves as a proportion of the ground area they cover. In tall-cut grass, it's not uncommon to have an LAI of 4, which means there is four times as much leaf surface area for a given ground area (e.g., four square inches of grass leaves per square inch of ground). As mowing heights decrease to putting green heights, the LAI can drop to 1 or less.

In Wisconsin our grasses have to build up sugar supplies to use during the winter for respiration. Respiration is the process of degrading sugar molecules to use for energy. Respiration rates are much lower in the winter than during the growing season, but sufficient sugar production in the autumn is needed to last through the winter as photosynthesis to replace sugars is usually absent until spring. A sufficient sugar supply is also needed at the end of winter to help turf resume growth as cold temperatures can still inhibit photosynthesis even after snow melts.

Proper mowing is essential for enhancing turf plant sugar supplies. One common mistake is to mow lower than normal at the last mowing of the season. Unfortunately, this often removes much of the actively photosynthesizing leaf material which cool temperatures and short daylengths prevent from being replaced. Nearly 80% of a turfgrass plant's sugars are stored in the shoots and leaves. Turf "scalped" in the autumn may not be able to produce sufficient sugars to produce a high quality turf in the spring. While the slower leaf growth rate in the autumn often allows for reduced mowing frequency, mowing should still be conducted so as not to remove more than one-third of the leaf material at any one mowing (i.e., the "1/3 Rule"). If the turf has been stressed due to climatic conditions, excessive play, and/or shorter-than-desirable mowing heights during the summer, raising the height of cut slightly can have significant benefits for turf quality during the autumn and the following spring.

Fertilization. Fall fertilization is commonly used to provide nutrients to the turf when leaf growth rate is slowed but buds for next year's tillers are forming and roots are actively growing. Usually there are two time periods for "fall" fertilization: late August/early September (which is early enough to encourage leaf growth for several weeks so turf damaged in the summer can recover) and late October/late November.

The late fall fertilization should be applied right after leaf growth for the year has stopped (Danneberger, 2006). Fertilizing earlier than this, while the temperatures are still high enough for leaf growth, can encourage leaf growth which depletes the sugar supply and increases leaf succulence (increased water, nutrient content). Succulent leaves are more susceptible to snow mold damage and winter injury (Stier and Fei, 2008). From an agronomic standpoint, both fertilizations should use mostly water-soluble (fast release) N sources. However, what is good for the turf may not be best for the environment. A growing body of evidence indicates a significant amount of the late fall application of water-soluble N may leach past the root zone and possibly contaminate groundwater (Frank et al., 2006; Mangiafico and Guillard, 2006). Generally, no more than 1 pound, and possibly less, of N/1000 ft^2 (about 44 lbs/acre) should be used at either one of these autumn fertilizations. Sand-based root zones may not be able to retain much more than 0.5 lb N/1000 ft^2 from a single application. Dan Lloyd, a graduate student at UW-Madison, is currently researching the amount of N which can be absorbed by creeping bentgrass and annual bluegrass as temperatures decline in the autumn.

Irrigation. One of the ways turfgrasses survive winter is by decreasing the amount of water in their tissues ("hardening"). Cool-season turfgrasses produce specialized proteins in the autumn which can either bind water to prevent it from freezing or, along with sugars, act as antifreeze to lower the freezing point of plant sap (Stier and Fei, 2008). Other specialized proteins form which help protect the membranes of plant cells from freezing damage. Superintendents can help avoid winterkill occurrence by reducing or eliminating irrigation early enough in the fall to help the turf plants "harden". Persistently wet areas on putting greens or other high profile turf areas should be drained, either by installing drain tiles or reshaping the topography. Otherwise, these areas will likely be the first to winterkill.

Use secondary cultural practices as needed

Autumn can be a great time to improve turf density and quality. Turf killed by disease or environmental stresses can be replaced by either overseeding/interseeding or encouraging surviving nearby grass to spread. Creeping bentgrass is especially adept at spreading onto barren ground as long as sufficient nutrients and water are provided. The number, size and growth of stolons appears

to increase as mowing height increases: consequently, creeping bentgrass will often fill in barren areas on fairways quicker than a similarly sized area on a putting green. Stolon development depends on the turf plant having sufficient sugars to expend on stolon production, much as a person's ability to purchase a luxury item depends on their ability to first pay for food, shelter and clothing. Increased mowing heights result in more leaf material which allows the plants to produce more sugars.

Cultivation which slices existing stolons can encourage them to develop new plants from their growing points when the stolons are severed from the mother plant. Overseeding bare areas should either be done in the late summer/early fall or as a dormant application once all chance of germination has past. Overseeding in the middle of autumn (e.g., early to mid-October) when temperatures are high enough for germination but too few weeks exist for the seedlings to mature can subject the seedlings to winterkill. Dormant overseeding, while usually not as efficient as overseeding earlier in the year, can still be beneficial as the seeds sprout early in the spring (Stier et al., 2008). Interseeding is a term used when seed is introduced into an existing turf stand. A slit-seeder is usually used for interseeding as the furrows cut into the ground and seed is deposited directly into the soil. Seedlings will grow and prosper only when the surrounding turf is sufficiently sparse to not compete with the seedlings for water, nutrients, and space. Interseeding can either be performed in the late summer or as a dormant event in late fall.

Topdressing is usually applied at the same time as cultivation and/or overseeding/interseeding. Topdressing at this time ensures some soil to stolon/seed contact for best turf growth. Some superintendents will apply a thick layer of topdressing to putting greens just before winter to help prevent winter desiccation.

Synthetic winter covers are increasingly used to prevent winter desiccation instead of topdressing. A variety of winter cover types exist in the marketplace, and it's vital that the correct type of winter cover be used. In most cases, a lightweight, woven cover with small holes for air movement is the best choice. Ideally, covers should be placed on putting greens

after the ground has frozen, or at least after all turf growth has stopped for the year. If placed on turf too early in the autumn, soil temperatures can be increased enough to stimulate new turf growth which will often be lush and succulent, and particularly prone to winterkill or snow mold disease. Some superintendents will knowingly use covers in autumn to encourage turf growth if they need the turf to recover from summer damage. This can be a gamble but sometimes needs to be done. More information on winter covers can be found in a previous edition of The Grass Roots (Stier, 2003).

Fungicide applications are vital in Wisconsin to prevent snow mold diseases from devastating low-cut turf. The UW-Madison turf pathologists conduct several large fungicide trials across the state each year to provide superintendents with the latest information on the best available products. However, winter thaws which expose turf plants to sunlight may cause fungicides to be degraded before the winter is over, and in those years superintendents correctly wonder if a mid-winter fungicide application is needed. In order to determine if mid-winter fungicide applications are needed during thaws, the UW-Madison turf team received a GCSAA grant this year to research the degradation rates of iprodione (Chipco 26019) and chlorothalonil (Daconil). We will be using an antibody test to measure the amount of fungicide remaining on or in the turf at various periods during the winter and correlate those amounts to snow mold disease. The test works on the same principle as the home pregnancy tests. If our approach works, superintendents might someday be able to use such a test to determine if a repeat fungicide application is necessary.

Ultimately, each golf course situation is unique. Soil types, budgets, grasses, climate, and level of play all create distinctly different challenges which require specialized approaches. I expect this is one of the reasons superintendents are often eager to attend educational sessions whether through the WGCSA, the WTA, the GCSAA, or other venue. One of our responsibilities at the university is to develop and provide the information superintendents need to make decisions for maintaining golf turf at whatever level is needed, including how best to "button up the turf" for winter.

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