Preparing for Winter

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A tough year for growing grass

Just the other day an assistant superintendent told me how he was looking forward to fall. He was looking forward to the cooler weather and, no doubt, fewer golfers. This year has been difficult for turf managers throughout the state starting with extensive winterkill and continuing on with summer heat stresses. Indeed, I've had more than a few calls regarding summerkill, especially from those courses trying to re-establish turf killed by winter. Even with irrigation our turf struggled to stay green and recover from routine golf-related damages under high summer temperatures. Autumn is when we traditionally see grass rebound and increased turf density. Fewer golfers doing less damage is one reason. But the biggest reason is biology. Our cool-season grasses simply grow best at temperatures 60°-75°F. Understanding how grass responds to autumn conditions is important for getting the best grass possible the following spring.

Grass grows differently under autumn conditions

Progressively cooler temperatures and declining hours of daylight combine to produce physical growth changes in turf plants during the autumn. The amount of actual growth (e.g., leaf mass) increases dramatically compared to summer growth (Fig. 1). Unlike during spring conditions though, much less leaf material is mowed because the growth pattern has altered. Shoot growth becomes prostrate (horizontal) compared to the upright (vertical) shoot growth seen in the spring. The bulk of bud development occurs at this time of the year, setting the stage for numerous new shoots in the spring. The prostrate shoot growth and bud development are important for maintaining dense turf cover to crowd out weeds and produce high quality turf. Root growth, which usually declines during the summer, begins growing rapidly and will continue until the soil freezes, long after the mowers

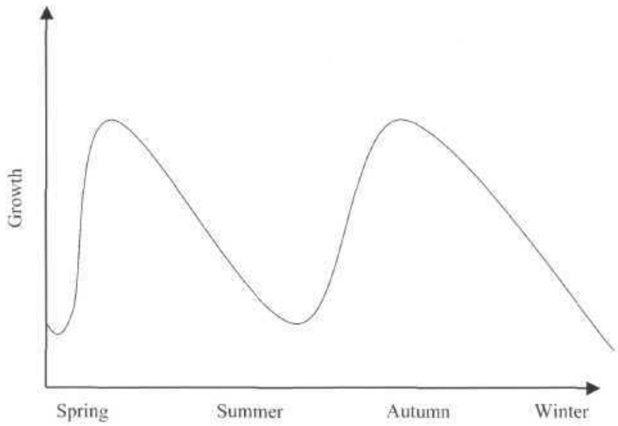


Fig. 1. Idealized diagram of cool-season turfgrass growth during the year.

have been put away for the year. Drought and other stresses during the critical autumn period can spell disaster for the following year.

The unseen changes inside the grass plant

During autumn turf plant cells become smaller and walls thicken, toughening cell walls to resist ice punctures. More importantly the cooler temperatures of autumn improve the efficiency of photosynthesis: in other words, more sugars are produced per unit of carbon dioxide absorbed by the plant compared to production during high summer temperatures.

Different types of sugars are produced and are used in several ways. Some are used immediately for growth as they usually are throughout the year. Fructans are large sugar molecules that are stored to fuel respiration during the winter when photosynthesis isn't possible, much as hibernating animals burn fat. Smaller sugars such as glucose and sucrose are used as water soluble "osmolytes" in plant cells where they serve as a type of antifreeze to prevent cells from freezing.

Special proteins are produced by turfgrasses which also act as antifreeze by binding water in plant cells. Over time the osmolytes, freeze-protecting proteins, and stored sugars are degraded in the plant and a loss of cold hardiness occurs. Cold hardiness increases during November, achieving a peak in December and January then declining in February with a near total loss by March.

The ability to produce excess sugars and cold-stress proteins in the autumn is important for each turf plant's winter survival. Some plants won't make it but most will survive. The amount of attrition depends to some degree on turf management during the autumn and health of the plants coming out of summer. Plants severely damaged from summer stresses will be delayed in their ability to grow enough leaves by early autumn to produce excess sugars for storage. Research at the University of Wisconsin-Madison indicates summer shade stress can be another cause of attrition during winter conditions as smaller amounts of stored sugars may be exhausted before winter's end (Steinke and Stier, 2004).

Managing for best results

Mowing. One of the common misperceptions is that turf should be mowed especially short at the last mowing. In reality, maintaining the turf at a normal height throughout the autumn is important for letting it accumulate sugars. Continue using the 1/3 rule by never removing more than 1/3 of the leaf tissue at any one mowing. Removing more than 1/3 of the leaf tissue at one mowing literally stops growth and forces the turf to use sugars in storage to restart growth.

Fertilizing. Turf is always undernourished, which is why we see such a response to fertilization. I recall vividly a superintendent telling me he didn't like to apply fertilizer in the autumn because he didn't think it necessary. Given the tremendous potential for turf growth (read: recovery from summer stress) plus bud and root development it doesn't make sense to not fertilize in the autumn. Early September and late autumn (dormant) applications of fertilizer are crucial for helping turf maintain optimal health before winter and for optimizing spring growth.

The early September applications stimulate leaf, stolon, rhizome, and root growth. The additional leaves increase the amount of sugars the plant can produce and store for use during winter. Bud formation also depends on nutrient availability throughout the fall. The late autumn, or dormant fertilization, is applied around the time of the final mowing. Late October or early November is usually the time for dormant fertilization, though dates may be sooner in northern Wisconsin and later in southeastern Wisconsin.

Water-soluble fertilizers work great for getting nitrogen into the plant at this time though slow release or natural organic fertilizers could also be used. Usually I like to see a mixture of water-soluble and insoluble nitrogen sources. No more than one lb nitrogen per thousand square feet should be applied in accordance with current Extension recommendations.

Dormant fertilization is primarily intended to feed roots and buds; cool day/night temperatures don't allow much if any leaf growth. The exception is when we get a warm stretch of weather in late November/December which occasionally forces Wisconsin superintendents to get the mowers out. Since golfers are usually showing up on these days anyway, the fertilizer still benefits the turf because the buds being formed will be needed in the spring to repair this late autumn/early winter play.

Unless existing turf damage is being repaired, avoid fertilizing during mid-autumn (late September to mid-October) because temperatures are still warm enough to stimulate new leaf growth which requires sugars and may reduce the amount of sugars stored for winter.

Irrigating. Cooler days in the autumn reduce the need for irrigation. Part of the cold-hardening process requires lower moisture levels in the plant. Of course, a water deficit is not desirable either. In any case, keeping the turf moist enough to stay green during September will help leaf growth. Unfortunately there are no hard and fast guidelines for the amount of irrigation required during autumn. We have had dry autumns during which irrigation was necessary. In any case, irrigation rates can gradually be reduced beginning in early September until the irrigation system is closed down for winter. The most important consideration is to avoid overly succulent (well-watered) turf immediately before freezing conditions set in.

Overseeding thickens turf

Overseeding during the autumn will help the turf thicken up. The best time to apply seed is between mid-August and mid-September because temperatures are favorable for germination and seedling development. By the time you read this, your next best chance will be a dormant seeding: seeding when temperatures are cold enough that the germination period is past.

Dormant seeding requires an average daily temperature below 40 F. The idea is that the seed stays in place over winter and germinates early next spring. In our studies at the O.J. Noer Facility, dormant seedings can germinate in April. While seed planted several weeks later in the spring may "catch up" by mid-summer to dormant-seeded turf, its often difficult to seed in early spring due to poor weather (rain, mud) and time demands for other projects.

Dormant seedings are much riskier than late summer seedings, though, as much of the seed may die during winter. It is usually recommended to use double the seed amount for dormant seedings to account for high seed mortality. Some type of mulch (e.g., straw or wood-based mat) is always recommended to hold seed in place during the winter and to help maintain favorable moisture for seedling development when bare soil is seeded. Slit-seeding or seeding in conjunction with core aeration are two other good methods, especially when some the goal is simply to thicken up an existitng but thin turf.

Wiinter protection.

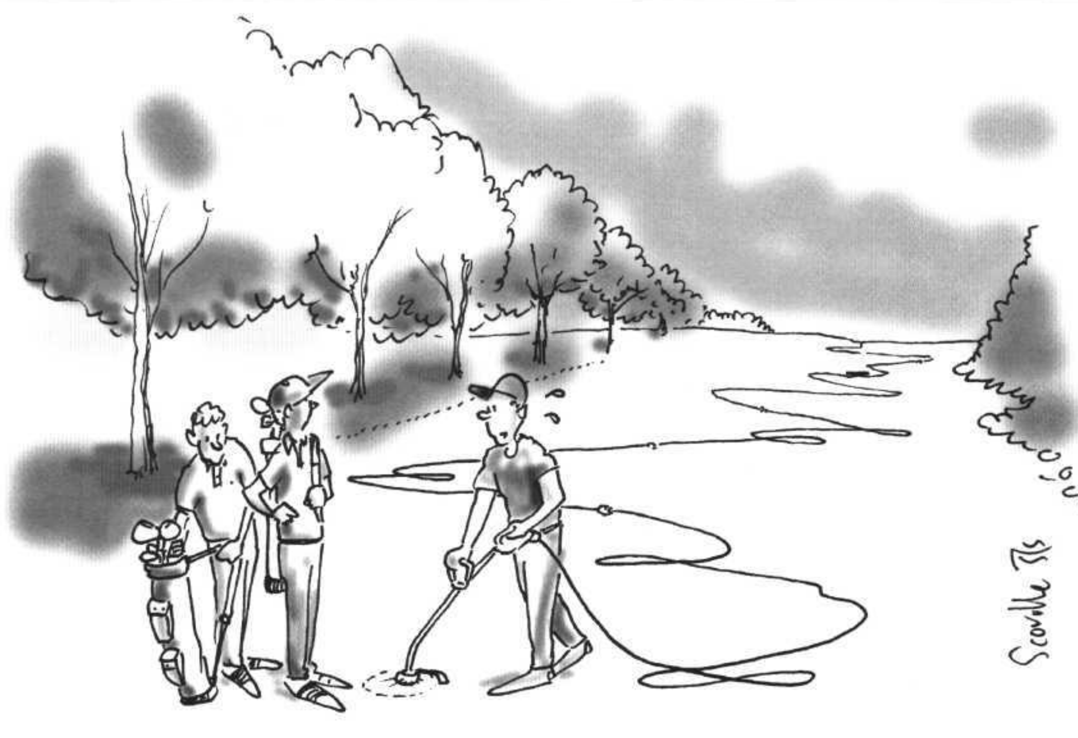
Low winter temperatures, ice cover, and snow molds can kill turf during the winter (Stier, 2003; Stier, 2005). In our state fungicides are usually required to prevent snow molds from killing closely mown turf. Our pathology group, led by Dr. Jung has done a good job of testing and reporting efficacy of the different products and combination's. A popular approach is to use combinations of chlorothalonil (e.g., Daconil) and iprodione (e.g., Chipco 26GT). Occasionally fungicides seem to "run out" towards the end of the winter and research is still ongoing to determine the best ways to avoid this problem.

"Breathable" turf covers (e.g., Evergreen™) are often useful for protecting elevated greens and tees, particularly those with sand-based root zones, from desiccation during winter. A heavy layer of topdressing can accomplish the same objective.

Of particular interest this year may be covers to prevent ice-related damage. Unfortunately no cover type or method has proven to be effective against winterkill in all situations. Ice formation can kill large areas of turf and at this time we still have courses in Wisconsin recovering from ice-damaged turf. Ice forms where internal and especially surface drainage is poor. The ice layer prevents gas exchange with the atmosphere and can allow gases such as carbon dioxide, cyanide and methane from soil respiration to build to toxic levels.

In addition, during late winter and early spring thaws the melting ice hydrates turf plants, then water freezes inside the plants when temperatures drop. The resulting ice can kill the turf as ice crystals either puncture the cells or draw water out of the cells. Ice inside plants in December and January is usually less of a concern because plants are still relatively winter hardy. In the short term, gas exchange problems caused by surface ice can be prevented by poking or melting holes in the ice. In the long term, and to prevent crown hydration, good surface drainage is key for allowing water to move off the turf surface. Turf at one of the golf courses I visited this spring clearly showed the impact of crown hydration as turf was killed at the lower parts of the greens where drainage off the green was prevented by small berms at the edge of the greens.

Short of good drainage there is no magic bullet for preventing ice damage. At the winterkill symposium



"WE'RE DOING ALL OF THE FAIRWAYS LIKE THIS NOW; DON'T HAVE TO BUY GAS."

hosted by Jerry Kershasky at Westmoor CC this past March, Bob Vavrek showed a method used in western Canada to prevent ice kill. The procedure included laying tarps on the green followed by extensive depths of straw or hay and capped with a second tarp. This method seemed to protect against ice damage on greens though at great cost and effort. Unfortunately when I asked a superintendent from the region about the method, he said that while it does protect from ice, the turf dies in winters when no ice forms. Sounds like all we have to do is predict the winter weather accurately several months in the future and we can prevent winterkill! More information on wintercovers and topdressing can be found in: 1) Minner et al., 2003, and 2) Stier, 2003b.

The last word

Maximizing winter hardiness is done through a combination of maintaining mowing heights, fertilizing, and slowly reducing the amount of irrigation during autumn. Turf covers can provide some protection against winterkill, but good drainage is ultimately the best way to protect against ice formation. Ultimately winterkill will always likely be a fact of managing turf in Wisconsin. Superintendents will need the support of membership to allow superintendents to do their job to get turf back in play.

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