Greening Up the Golf Course

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Being in San Diego last month made me long for the look and smell of green grass. Each spring as snow melts, golfers come and play, also longing for that look and smell of green grass. Some superintendents shudder, knowing the grass may not quite be ready, or perhaps wishing for a few more days to finish winter projects. But the desire remains: green grass.

Grass often turns brown during winter when its exposed to the open air or when its killed by disease or low temperature fungi. Exposure to open winter air kills foliage either by desiccation or by sunlight. (Foliar death may actually enhance the survival of the plants though as desiccation is ultimately reduced.) Chlorophyll, a complex molecule that gives foliage its bright green color, is both stimulated and degraded by sunlight. At freezing temperatures, however, the plant is unable to produce new chlorophyll, causing turf to turn brown. Of course, not all grass that's exposed to the environment throughout the winter will turn brown because some of the foliage may be protected. Furthermore, genes in a given plant or variety may protect chlorophyll against degradation.

The rate of spring greenup depends partly on the grass genetics, temperature, and sunlight. *Poa annua* and perennial ryegrass are often the first grasses to greenup as long as they survived winter. Creeping bentgrass is a bit slower, while Kentucky bluegrass is often the slowest of the most commonly-used cool-season turfgrasses. Rates of greenup vary among varieties within a species. For example, most common types of Kentucky bluegrasses (e.g., 'Kenblue') green up sooner than many improved types ('Fairfax', 'Award') (NTEP, 2003). If leaves are already brown then one must wait for new leaf production. Under ideal situations, cool-season grasses can produce one new leaf in about 5-6 days. The time interval between production of each leaf is called the phyllochron. The phyllochron is increased at sub-optimal temperatures or when nutrients or irrigation are in limited supply. In these cases spring greenup can often be enhanced through management.

Greening up the grass

Mowing is a tremendous stimulant for growth. On a brown turf, mowing removes the dead foliage, exposing surviving plant parts and the soil to warm sunlight. Soil temperatures increase and biochemical reactions start producing new cell walls, proteins, and other compounds needed for growth. While shoots of cool-season turfgrasses can grow at temperatures as low as 40 degrees Farenheit, optimal temperatures are between 60-75 degrees (Beard, 1973). Roots may grow at any temperature above 32 degrees, but optimal growth is achieved between 50 to 65 degrees.

Removal of green tissue helps too. In turfgrasses, mowing stimulates the production of hormones in the remaining plant tissue that are responsible for new tiller production. Hormones like cytokinins stimulate new cell division. Auxins and gibberellins stimulate cell enlargement. An unmowed turf plant has relatively few tillers, while plants consistently mown at an optimal cutting height have numerous tillers and produce a thick turf. Mowing brown grass can actually hasten spring greenup by a few days to weeks when combined with needed nutrients and moisture. Once enough green tissue exists for photosynthesis to produce more carbohydrates than is used by respiration, growth jumps tremendously!

Low soil temperatures in the spring can keep nutrient availability to a minimum. Air temperatures warm first, of course, then the upper soil layer where turfgrass crowns reside. Since soil thaws from the surface on downwards, it is often new root production from the crowns themselves that is important for water and nutrient uptake during spring greenup. Small flushes of nutrients may occur as snow melts and as nutrients are released from dead foliage, but these may not be enough to meet turf needs until soil-bound nutrients are released.

Nitrogen particularly can be in inadequate supply because the microbes responsible for releasing nitrogen from organic material are relatively inactive in cold and frozen soil. Microbes, primarily bacteria, are relatively inactive in cold and frozen soil. Thus it is not uncommon to see chlorotic patches and/or slow-growing turf in the spring where soil temperatures have remained cold. Adding moderate rates of water-soluble nitrogen (e.g., 0.5 lb per thousand square feet per month) early in the spring can stimulate new growth without seriously depleting storage carbohydrates which will be needed for root growth as soil temperatures increase. Phosphorus may also be in limiting supply in cold temperatures when root activity is reduced (Carrow et al., 2001). Where phosphorus has not been banned by local ordinance, an application of phosphorus fertilizer may aid new growth.

Irrigation is also helpful for stimulating spring greenup. Once a new leaf develops from the crown, its water that drives the expansion of each cell, ultimately accounting for most of the growth that is seen. Of course, irrigation also ensures the nutrients in fertilizer are solubilized for plant uptake.

As discussed in the previous issue of The Grass Roots, covers can be used to warm soil temps and hasten spring greenup. Due to cost and labor issues these are mostly useful on greens and tees. Medium to light colored covers are preferable as black materials may increase temperature to undesirably high levels. All covers can potentially increase disease so constant monitoring is required in case they need to be removed. If the turf is not snow-covered it may be advisable to first apply protective fungicides. Lush growth under covers can also be detrimental if sudden drops to sub-zero temperatures occur because cold hardiness decreases quickly as turf greens up.

Growth regulators are often used in the spring for *Poa annua* control. While certain products like Primo may be effective for producing a darker green color during the growing season, none of these growth regulators have been shown to enhance spring greenup. In fact, if used too late in the preceding autumn some growth regulators may actually delay spring greenup up to several weeks. While applications of gibberellic acid (GA) can counteract the effects of GA-inhibiting growth regulators (trinexapac-ethyl, paclobutrazol, and flurprimidol), any compound such as GA that relies on transport through the leaf is unlikely to be effective when applied to brown, dead leaves. Use of plant growth regulators should be confined to label instructions which generally indicated application to green, actively growing turf.

In some cases grass may have been killed by winter conditions or even thinned out during the autumn. There's no question that seed germination is most rapid when soil temperatures are warm: that's part of the reason Kentucky bluegrass germination can range between seven and 21 days. Research at Purdue University, though, showed an early spring seeding was key to success if seed was planted in the spring. For a golf course where traffic continues to increase after snow melts until it peaks in the summer, early seeding can be especially important. Even if snow is still in the forecast, by early spring its unlikely to stick around and the limited freezing/thawing may even help germination by scarifying the seed coat. If possible, add a bit of mulch to keep the seed in place and provide favorable germination conditions. Straw works great, though some superintendents favor paper mulch pellets or other materials. On slopes, thin wood fiber-based "blankets" work well for preventing erosion and acting as a mulch for germination.

Conclusion

Plant genetics dictate only part of spring greenup. Early mowing, moderate fertility, and sufficient moisture can be used to hasten spring greenup. Covers may be useful on greens and tees to warm the soil but must be used cautiously to avoid disease and cold stress problems. Growth regulators may be useful for reducing *Poa annua* seedhead production but won't increase spring greenup. Finally, bare areas should be seeded as soon as possible in the spring rather than waiting for soil temperatures to warm to optimal levels.

Literature Cited

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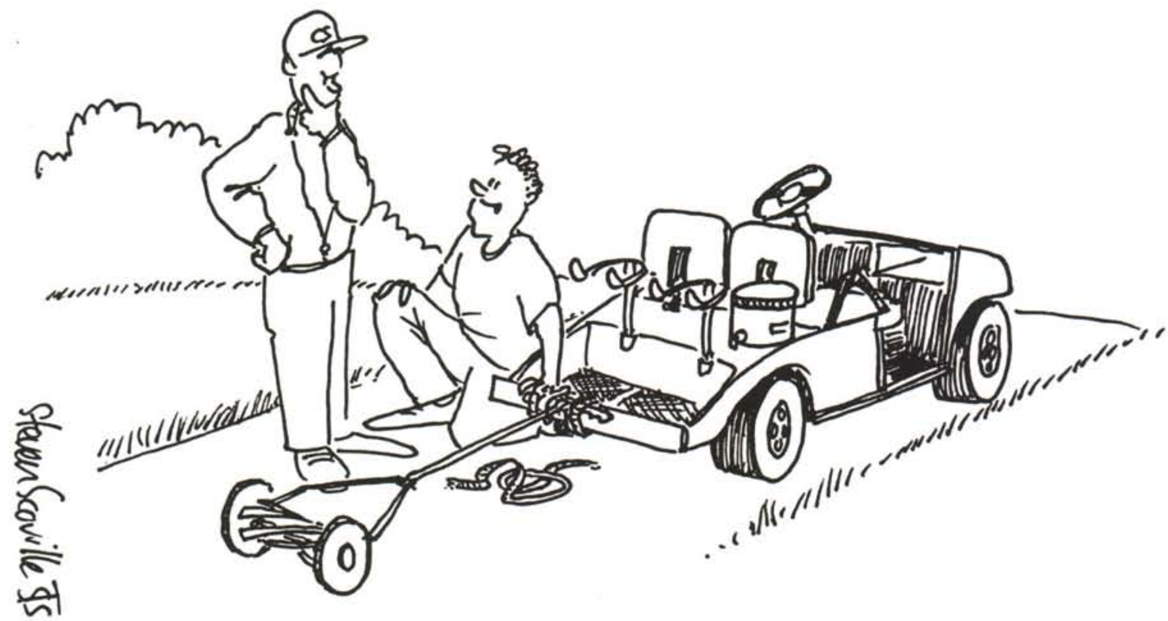

"WE JUST TIE ONE OF THESE TO EVERY CART AND, VOILA! WE CUT OUR MOWING BUDGET IN HALF!"