Turfgrass Winter-Kill Recovery Strategies

Bert McCarty and Grady Miller
Clemson University and N.C. State Universities

Parameters Influencing "Winter-Kill"

Several parameters influence the susceptibility of warm-season turfgrasses to low-temperature stress; however, only a few are controllable by turfgrass managers. Protecting turfgrass crowns from low-temperatures is essential for survival as leaves, roots and lateral shoots regenerate from these. Temperature, freeze and thaw frequency, and freeze and thaw rate are factors outside a turfgrass manager's control. Conversely, several parameters within the control of turfgrass managers include:

Shade

Exposure of turfgrass plants to sunlight is critical for several reasons, such as food production (photosynthesis) and pre-stress hardening. Prolonged shade reduces carbohydrate levels in turfgrass plants, produces weaker plants, and suppresses soil temperatures (**Figure 1**). Bright sunlight exposure also signals plants to harden off during fall. Northern or northeastern facing slopes receive less (or little) direct sunlight in the winter months and are more susceptible to low-temperature stress.

Irrigation

A certain amount of water or moisture is needed for crown tissues to survive low-temperature stress. If a moisture deficiency occurs, crown tissues become desiccated; thus, they are severely weakened and more susceptible to low-temperature stress and traffic injury. Maintaining soil moisture at or slightly below field capacity and preventing standing water helps keep crown tissue properly hydrated.

Drainage

Poor surface and/or subsurface drainage can result in direct low-temperature damage or injury to the crowns of turfgrass plants. Turfgrass plants growing in areas with poor drainage (surface or subsurface), high compaction, or excessive irrigation are at a greater risk of low-temperature injury.

Traffic

Traffic (either vehicular or foot) can be very damaging to frozen turfgrass crowns, leading to the eventual death of plants. In addition, traffic leads to soil compaction that reduces soil oxygen levels (porosity) and water infiltration and percolation

rates. Most often these problems are observed on teeing areas, approach areas to tees and putting greens, and in golf cart traffic areas onto and in the fairways. Reducing, diverting, or withholding traffic can aid in relieving soil compaction and decreasing the chances of low-temperature stress and injury.

Turfgrass Selection

Turfgrass species and varieties or cultivars within a particular species have varying degrees of low-temperature tolerance. Generally, turfgrass cultivars possessing greater low-temperature tolerance tend to exhibit a deeper growing, more dense rhizome network, thus, are more insulated by being deeper in the soil profile. Inherent cold tolerance differences between current bermudagrass greens cultivars are mostly trumped by other parameters such as shade, mowing height and desiccation.

Turf Covers

Turf covers may help protect turfgrass crowns from direct low winter temperatures and desiccation (**Figure 2**). Artificial covers which use an air layer to insulate the turf from extreme moisture and temperatures are easiest to use, however, hay and pine straw are successful used.

'Icing' Greens

The theory behind icing greens is to provide a thin ice cover which would hopefully moderate the soil temperatures around 32 F. However, ice is considered a very poor insulator. If it remains for extended periods on turf, root suffocation can occur from the buildup of toxic soil carbon dioxide, moisture extracted from plant cells (think, freezer burn) as well as providing poor insulating properties.

Diagnosing Low-Temperature Injury

Winter-kill is seldom an "all or nothing" phenomenon. Turf grown in stressful conditions such as shade, low mowing heights, and/or compacted soils typically is most susceptible. Secondarily, sites with standing water or powder dry soil during a freeze experience a certain degree of winter injury. North facing slopes are also more susceptible to winter injury. Since most of our turf sites do not fully experience one or more of these conditions, winter injury is actually just slower green-up vs. complete kill. Until spring green-up occurs, one can determine if they have experienced winter kill by taking a 4-inch plug about 4-inches deep, placing it in a sunny warm location (such as a greenhouse or southern facing window sill) and after 10 to 14 days, should see the grass greening up, assuming no winter injury has occurred.

Herbicide Use and Low-Temperature Injury

An obvious question involves potential winter-kill and possible use of preemererergence (PRE) herbicides, especially if one is resprigging or resodding damaged areas. If considerable winter damage is suspected, then mitotic inhibiting herbicides such as prodiamine, dithiopyr, and pendimethalin can safely be used on thin warm-season grasses if applied at half rates. The other half is then applied 60 days later, typically when one can fully evaluate the extent of damage. For instance, instead of using the full 0.75 lbs active ingredient per acre of prodiamine, use 0.38 lbs ai/a initially and apply the remaining 0.38 lbs ai/a ~60 days later. By this time, the amount of winter injury should be obvious and if none is seen, the follow-up application can be safely made. Indaziflam should not be used until damaged areas fully recover or newly planted areas are fully established.

For those expecting extensive winter-injury and feel the 'half-rate' strategy too risky, several additional options exist. The first is to use oxadiazon as your PRE product as this has little effect on turfgrass rooting, thus, can safely be used. This product should also be considered if extensive turf injury occurs and replanting by sprigging, plugging, or sodding is needed. If not used, annual grassy weeds such as goosegrass and crabgrass typically become a never ending battle. Like oxadiazon, a newer product, flumioxazin (SureGuard) does not to interfere with normal rooting of turfgrasses. The second (and less advisable) strategy is to wait to assess any potential winter injury and use postemergence herbicides for weed control. In bermudagrass, this involves MSMA (golf and sod) and quinclorac-containing products, and fluazifop, quinclorac, and fenoxaprop in zoysiagrass. The problem with relying solely on a POST strategy is that weed pressure is typically heavy following cold winters, thus, multiple applications would be needed and should begin when the first several leaves of the weeds are visible. Of course, mature weeds are also more difficult (and costly) to control.

Figure 1
Winter-kill in the Carolinas is rarely due solely to low temperatures alone. It is often an accumulative effect of shade, traffic, scalping (close mowing), and dessication along with low temperatures.

Figure 2
Artificial covers have been a game changer in reducing winter damage. Shown is are green streaks where a cover was folded over from wind, providing double protection.