WINTER CROWN HYDRATION INJURY ON TURF: CAUSES AND CURES

John Roberts
University of New Hampshire
Durham, NH

Crown hydration damage continues to be one of the most destructive yet least preventable forms of winter kill. It is a problem generally associated with turf growing in wet soils whose saturated cells rupture and die following extreme fluctuations in freezing and thawing temperatures. Many of the specific environmental conditions required to cause damage are not fully understood. However, serious injury has been reported when warm temperatures are followed by rapid decreases in soil temperatures below 20°F.

Golf courses located in the central and northern states are prime targets and can be damaged anytime throughout the winter. However, turf in these regions is especially vulnerable to crown hydration damage in the 2 to 3 week transition period during snowmelt in early spring when standing water and saturated crown tissues often exist on semi-frozen soil surfaces. This is especially apparent on greens which are not contoured to allow for surface run-off. Also, in this transition period, wide daily temperature changes are common, the turfs carbohydrate levels are low, and the young tissues being produced are highly susceptible to crown hydration damage.

The past couple of New Hampshire winters exploring the causes of crown hydration damage have uncovered some interesting results. Here are a few of the key findings:

1. **TRANSITION PERIOD IS THE MOST CRITICAL:** During the 2 to 3 week snowmelt period in early spring standing water and saturated crown tissues often exist on semi-frozen soil surfaces. Wide and rapidly changing freezing and thawing temperatures also occur during this period. In addition the turf is physiologically in a weak condition and the young new tissues being produced are extremely more vulnerable than tissues found in dormant turf during mid winter. This is not to imply that turf cannot be killed during the months of December through February. It can. However, the environment (temperature fluctuations) needed to damage turf need to be more severe.
2. **POA IS THE MOST SENSITIVE SPECIES:** This should come as little surprise to many that have witnessed just the loss of Poa in greens equally mixed with bents. Between the various bentgrasses the velvet and creeping types were the most tolerant. The colonial bent was intermediate (yet considerably more resistant than the Poa).
3. **FALL POTASSIUM IMPROVED TOLERANCE:** During the hardening period of late fall, samples fertilized with a high potassium diet (having a 1:2 nitrogen to potassium ratio) had 30 percent less damage than samples not receiving potassium. The least tolerant samples were those fertilized with nitrogen only (urea at 0.75 lbs.) during this critical hardening period (30 to 40 days before dormancy). Avoiding practices that promote active growth during the hardening period help prepare the turf for the demanding winter months ahead.
4. **RAPID TEMPERATURE CHANGES ARE MORE DAMAGING:** Warm days and quickly freezing temperature changes at night result in greater damage than gradual fluctuating temperatures. When subjected to rapid reductions in temperatures under controlled freezer conditions 40 percent more injury occurred than to samples under field conditions. A snow cover during the transition

period serves as an insulator and helps protect the turf. The critical days follow the melt period (with or without early snow clearing) when the exposed and saturated soil surfaces are at 'the mercy' of Mother Nature.

5. **PREDICTING LETHAL TEMPERATURES DIFFICULT:** Due to its diversity and overall complexity forecasting the environmental conditions that result in damage will likely never be an exact science. However, guidelines can be established and improved as testing continues. In the trials at University of New Hampshire. for example the lethal soil temperatures to kill 50 percent or more of the Poa population in the transition period was 20°F and 10°F for the bents. To obtain this degree of damage the turf was subjected to 3 repeated freeze-thaw cycles with rapidly changing temperatures.

One of the key principals in reducing injury involves maintaining low crown hydration levels. However, under field conditions wet soil surfaces often exist as a result of the impermeable nature of frozen soils and the upward movement of water from the frozen soil below during the thawing periods. So over the years despite various attempts to eliminate crown hydration, large sections of greens can still be lost. Following severe winters field experience has shown turf (especially Poa annua) located in the portions of greens where water collects is the most often injured. This includes greens built with permeable soils and having sub-surface drainage.

A better understanding, innovative ideas, new technology, genetic breakthroughs and even small miracles might be necessary to help eliminate this complex problem. Clearly many fundamental questions remain unanswered. The ultimate fate of the turf still appears largely dependent on 'Mother Nature.' However, today's 'best management practices' help provide protection. These practices include: a) maximizing the bentgrass population, b) designing greens which allow for rapid surface run-off, c) constructing greens with permeable soils and installing drainlines for rapid sub-surface drainage, d) avoiding cultural practices which stimulate growth during the hardening period of late fall, and e) maintaining high potassium levels entering the winter.