

'Tis the Season for Freeze Injury

You should be thinking about it right now. Here's how it occurs and what you can do to prevent it

BY KARL DANNEBERGER

During the dead of winter, low-temperature kill or freeze injury concerns many superintendents. It's especially a worry to superintendents maintaining cool-season turfgrass in the northern United States and warm-season turfgrass in or near the transition zone.



Freeze injury occurs at temperatures at or below 32 F. To withstand freezing temperatures, turfgrasses acclimate by hardening, a process that begins in late summer or early fall. As turf leaves harden, their ability to withstand lower temperatures peaks in December and January.

Certain research projects have reported the LT_{50} (the lethal temperature at which 50 percent of the plants are killed). To determine the LT_{50} , researchers study the plants in their hardest stage and incrementally lower the temperature over time until the LT_{50} is reached.

When we talk about LT_{50} , we're not talking about air temperature. Instead, we're talking about the temperature around the growing point, whether at a rhizome or the leaf. For example, the temperature of a putting green under snow cover would approach freezing (32 F) while the air temperature above the snow cover might be several degrees below freezing — even lethal.

Contrary to what you might think, snow cover moderates the soil temperature around the growing point like

a blanket providing protection. Last year, for example, winter temperatures in the southeastern United States were cold enough to kill bermudagrass. In many areas, however, bermudagrass escaped injury because of snow cover.

Whether turfgrass avoids freeze depends on the location of the growing point. Plants with rhizomes deeper in the soil are better equipped

to avoid low temperatures than plants that only have crowns, since soil temperatures tend to moderate and don't drop as low as air temperatures.

Plants that have rhizomatous growth avoid low temperatures at the surface better than plants that reproduce only from crowns. The location of the crown is also important. The crown region of perennial ryegrass, for example, tends to sit higher than other cool-season turfgrasses, exposing it to a greater temperature extreme.

Resistance to freeze injury varies considerably among turfgrasses (Table 1). Creeping bentgrass and Kentucky bluegrass growing in the United States have little associated risk to freezing injury, while perennial ryegrass and

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Table 1

Freeze Stress Tolerance of a Selected Group of Turfgrasses

TURFGRASS	RELATIVE KILLING TEMPERATURE (F)
Creeping bentgrass	-31
Kentucky bluegrass	-6 to -22
Perennial ryegrass	5 to -3
Annual bluegrass	5
Bermudagrass	19
St. Augustinegrass	23

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annual bluegrass are potential candidates to suffer injury. Bermudagrass often risks freeze injury when it is grown north of where it's already adapted.

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So when is freeze injury the greatest concern? Turfgrasses begin to break winter dormancy during late winter or early spring. It is at this time that the greatest potential for freezing injury can occur. Turfgrasses are at a stage where the potential for injury is the greatest between the second and fourth weeks in February.

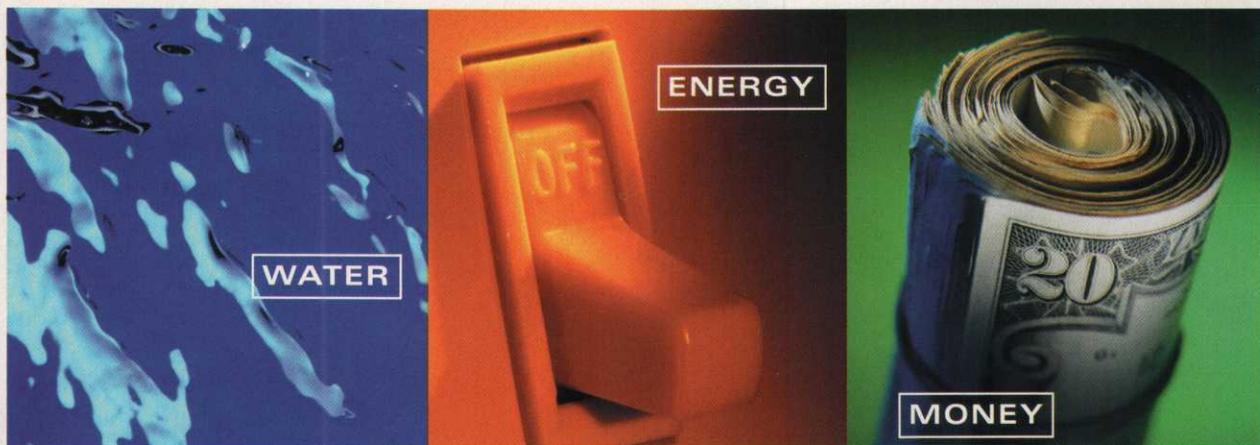
A likely scenario for freeze injury occurs during middle to late February when temperatures rise and the turf starts greening. If excessive moisture is present, a drop in temperature can cause rapid freezing around the crown (or growing point), which results in

death. It's possible to have multiple freezing/thawing cycles that can cause extensive freeze injury. In fact, this scenario killed considerable annual bluegrass and perennial ryegrass in the Northeast last winter.

To minimize freeze injury, superintendents should:

- maximize the hardening process;
- remove excess moisture from the crown and the surrounding site;
- avoid lush, succulent growth going into winter (succulent growth results in thin-walled, hydrated cells that are more at risk to freeze injury);
- consider a heavy topdressing before winter, which may provide protection to the crown from exposure to air temperature extremes; and
- install proper drainage in areas where water tends to stand.

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