WINTER INJURY: CAUSES AND PREVENTION

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Winter kill is a general term used to indicate any kind of damage to turf during the winter period. It is better to understand and use terms such as direct low temperature kill, winter dessication, and snowmold injury. Direct low temperature kill and winter dessication will be discussed in this review. For more information on winter diseases refer to Chapter 17 of "Turfgrass Science and Culture' by James B. Beard.

Winter dessication occurs when the water loss from leaf material exceeds water uptake from the soil during the winter period. In many cases the soil water is frozen and totally unavailable, while air and leaf temperatures are above freezing, allowing water loss to occur. Winter dessication is most severe: (1) during open winters with little snow fall, (2) on elevated sites, (3) on areas exposed to excessive wind movement and (4) on areas with high surface run off. Use of snow fence and other windbreaks reduce winter dessication by slowing wind movement and encouraging snow accumulation. On high maintenance, high investment turfs, mulches, topdressing or synthetic protection covers should be considered. Winter protection covers should be installed after the turf has stopped growing but before the soil freezes or the first permanent snow fall occurs. Appropriate fungicides must be applied first since protective covers provide an ideal environment for disease activity. The most effective synthetic covers are the viscose-rayon fiber, a plastic shade cloth, or a processed wood fiber. These covers protect against both winter dessication and direct low temperature kill.

Direct low temperature kill is a result of ice crystal formation within the tissues of the turfgrass plant. High water content of the plant (often caused by standing water) and periods of alternating freezing and thawing are the greatest causes of direct low temperature kill. The ability of the plant to withstand low temperatures is termed low temperature hardiness. Certain species are more hardy than others (see Table 1). Certain cultural practices can increase the low temperature hardiness of any one species by reducing the water content and increasing the carbohydrate content of the turfgrass plant:

1) Insure adequate surface and subsurface drainage. If drainage is not adequate and standing water occurs throughout the winter period, none of the following practices will be of any value in insuring winter survival.
2) Avoid excess nitrogen fertilization, especially during late fall. Nitrogen stimulates growth. Actively growing turfgrass plants lack hardiness due to reduced carbohydrate levels and higher water content of those tissues most prine to low temperature kill.
3) Provide a nitrogen-potassium ratio of 2:1 to 3:1. Not only a low nitrogen level, but a proper fertility balance provides for maximum low temperature hardiness.
4) Avoid excessive late fall irrigation. Irrigation rates should be

adjusted to maintain adequate levels of soil moisture but not enough to stimulate shoot growth in late fall.

5) Minimize thatch accumulation. Under thatch conditions the crown of the turfgrass plant is elevated above the soil surface where it is subject to the temperature extremes of the atmosphere.

6) Avoid close mowing. Shorter cutting heights result in increased injury due to loss of the leaf area needed to synthesize carbohydrates for the hardening process and loss of plant material needed for insulation from cold air temperatures.

Table 1. The Relative Low Temperature Hardiness of Nine Cool Season Turfgrass Species

ranking	species
Excellent	Rough bluegrass Creeping bentgrass
Good	Kentucky bluegrass Canada bluegrass
Medium	Annual bluegrass Red fescue Tall fescue
Poor	Perennial ryegrass
Very poor	Italian ryegrass