

Winter Injury of Cool-season Turfgrasses

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Objectives:

1. Examine underlying physiological and biochemical factors associated with winter injury of cool-season turfgrasses, including perennial ryegrass and annual bluegrass.
2. Provide superintendents with updated information and recommendations using the Northeast Winter Injury Initiative website.

Start Date: 2008

Project Duration: one year

Total Funding: \$3,000

Winter damage to perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) is a significant concern for turfgrass managers in northern climatic regions. The problems associated with winter injury of turf are complex and can result from several interacting factors including low temperature kill, crown hydration, desiccation, and low temperature fungi. Among these factors, research suggests that these cool-season grasses are particularly sensitive to winter temperature fluctuations and direct low temperature kill.

The physiological factors that predispose perennial ryegrass and annual bluegrass to freezing injury require further investigation. Therefore, one of the primary objectives of this project is to assess underlying physiological and biochemical factors that contribute to variability in freezing tolerance among cool-season turfgrasses. The long-term goal is to utilize this information to aid in the selection of freeze-tolerant turfgrasses and to help identify management practices that will maximize winter survival of these species.

To date, we have completed two controlled-environment studies that examined major physiological and biochemical changes during cold acclimation of selected freeze-tolerant and freeze-susceptible perennial ryegrass accessions from the University of Minnesota. In summary, we found that freezing tolerance was associated with rapid accumulation of water soluble carbohydrates in crowns during cold acclimation, particularly sucrose.

In addition, tolerant accessions exhibited a higher capacity to alter crown membrane composition (individual lipid classes and saturation levels) that could help to maintain membrane integrity at low temperatures. Therefore, the accumulation



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of protective compounds, such as sucrose, along with changes in lipid composition during cold acclimation may represent critical mechanisms to help to lower cellular freezing point and improve cellular stability of perennial ryegrass at low temperatures.

Further work is currently being conducted to compare freezing tolerance characteristics of annual bluegrass and creeping bentgrass (*Agrostis stolonifera*), a freeze-tolerant turfgrass species. Controlled-environment experiments will focus on loss of freezing tolerance (deacclimation) in response to fluctuating soil temperatures and its implications on winter hardiness.

The specific objectives of this project are: (i) quantify the critical temperature thresholds required for deacclimation of annual bluegrass and creeping bentgrass; and (ii) examine early physiological and biochemical changes in response to deacclimating temperatures, including changes in lipid composition, protein expression, and plant carbon balance. This project will be part of a larger collaborative initiative among researchers and turfgrass managers in the Northeast and Canada on

applying a comprehensive approach to study winter injury of annual bluegrass.

The results from controlled-environment experiments will be further tested in field trials at the Joseph Troll Turf Research Center. All research results will be posted on the University of Massachusetts Northeast Winter Injury Initiative website, which is available to turfgrass professionals.

Summary Points

- The accumulation of protective compounds, such as sucrose, along with changes in lipid composition during cold acclimation, represent critical mechanisms to help to lower cellular freezing point and improve cellular stability of perennial ryegrass at low temperatures.
- Research is underway to identify practices and conditions that can minimize annual bluegrass turf loss due to winter injury.
- Data obtained from university research will be updated on a website (www.umassturf.org/winterinjury), which is an essential component for disseminating important winter injury information to turfgrass professionals.