

# Freeze-tolerance Evaluation of Turf Bermudagrasses

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## Objectives:

1. Quantify freeze tolerance of advanced lines, recently released cultivars, and established bermudagrass standards using laboratory-based methodology.

**Start Date:** 2003

**Project Duration:** three years

**Total Funding:** \$30,000

Bermudagrasses grown in the transition zone are susceptible to winterkill. Several approaches to increasing freeze tolerance have been pursued. Breeding efforts, including classical crossing, induction of mutations, and genetic engineering, require a rapid and reproducible means to quantitatively evaluate freeze tolerance. Standardized, quantitative information on freeze tolerance is vital for scientists to track their progress in developing new cultivars. Freeze tolerance information is also important for turfgrass managers selecting bermudagrasses for the transition zone. A host of promising cultivars is emerging, along with a need to distinguish between promotion and performance.

Although test winters can provide an excellent indication of winter survivability, their occurrence is unpredictable and not reproducible. Therefore, we will quantify freeze tolerance of advanced lines, recently released cultivars, and established standards using laboratory-based methodology. This approach has been refined and used successfully to characterize turf bermudagrass freeze tolerance with results corresponding with field observations of winterkill.

One intention of the project is to align evaluated cultivars with those in the 2002 National Turfgrass Evaluation Program (NTEP) bermudagrass trial to the extent possible. Experiments were divided into vegetative and seed-propagated cultivars. Permission to use material was obtained from seven of eight sponsors and seed from the lots used in the NTEP trial was provided. Twenty-seven of the 29 seeded entries will be included in this study. Experiments with seeded bermudagrasses have been divided into five groups. Each group contains five randomly selected entries and two standards ('Arizona Common' and 'Riviera'), allowing limited comparisons across groups.



Freeze tolerance is being evaluated as regrowth following low temperature exposure.

Plants are established in Cone-tainers in a growth chamber using approximately 50 mg seed per Cone-tainer. Following establishment, plants are transferred to another growth chamber for acclimation at 8/2°C for 4 weeks. Cone-tainers are then placed into a freeze chamber for low temperature exposure. Four cone-tainers will be removed at test temperatures from -4° to -9°C for each cultivar.

Following thawing, plant response to freezing stress will be evaluated as regrowth. Visual observations of regrowth will be recorded for five weeks, then top growth will be harvested and weighed. Data will be reported as the midpoint ( $T_{MID}$ ) of the sigmoidal temperature versus survival and temperature versus mass of regrowth response curves. Analyzing regrowth on a log scale enables discrimination between vigorous and weak regrowth following exposure to sub-freezing temperatures. The first four groups of seeded bermudagrasses have been evaluat-

ed for freeze survival, while replicates of the fifth group are in various stages of establishment and acclimation.

The standards chosen for the seeded cultivars, 'Arizona Common' and 'Riviera', had freeze tolerance levels based on survival of -6.0° and -7.5°C, respectively, averaged over the four completed groups. Values were slightly warmer, ('Arizona Common' = -5.7°C and 'Riviera' = -7.4°C) when  $T_{MID}$  was based on fresh weight of survivors, reflecting vigor of regrowth after low temperature stress. 'Riviera' was significantly more freeze tolerant than 'Arizona Common' in each of the four series of experiments. Eighteen out of twenty cultivars had freeze tolerance levels similar to 'Arizona Common', but none were significantly less hardy. 'Transcontinental' and 'CIS-CD6' exhibited significantly greater freeze tolerance than 'Arizona Common'. 'CIS-CD6' and 'Riviera' were significantly more freeze tolerant than 'Transcontinental'. Experiments with seeded bermudagrasses will be followed by freeze tolerance evaluations of vegetative entries.

Substantial progress is being made by turfgrass breeders to develop seed-propagated bermudagrasses with improved freeze tolerance. Although many factors in addition to freeze tolerance will be assessed in making cultivar selections, choices are now available with freeze tolerance suitable for areas of the transition zone requiring superior winter hardiness.

## Summary Points

- Experiments are underway to evaluate freeze tolerance levels of bermudagrasses in the 2002 NTEP trial.
- Results from four of the five groups of seeded bermudagrasses show a range in freeze tolerance from -5.3°C to -8.7°C. 'CIS-CD6', 'Riviera', and 'Transcontinental' were the most freeze tolerant seeded bermudagrasses examined thus far.
- Freeze tolerance of vegetatively-propagated cultivars will be evaluated following studies with seeded bermudagrasses.