

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 for warm- and cool-season turfgrasses are subject to winterkill, resulting in loss of use and substantial costs in re-establishment. For example, extensive damage in the winters of 1977-78, 1978-79, 1989-90, 1993-94 and 1995-96 left many areas requiring re-establishment. Severe winters can knock out cultivars such as 'Vamont', generally considered to exhibit good cold hardiness.

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 provide an indication of winter survivability, their occurrence is unpredictable and not reproducible. Therefore, we are quantifying 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. To this end, experiments were divided into vegetative and seed-propagated cultivars. Studies are under-



Four cone-tainers are being removed at test temperatures from -4 to -9 C for each cultivar. Cone-tainers are then held overnight at about 4 C after removal from the freeze chamber. Following thawing, plant response to freezing stress will be evaluated as regrowth. Visual observations of regrowth will be recorded for five weeks.

way with freeze-tolerance evaluations of 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.

Due to space limitations, 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. Experiments will be conducted on at least three dates for each group with plantings staggered in time.

Plants are being 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 four 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. Cone-tainers will be held overnight at about 4 C after removal from the freeze chamber.

Following thawing, plant response to freezing stress will be evaluated as regrowth. Visual observations of regrowth will be recorded for five weeks. Data will be reported as the midpoint of the sigmoidal temperature versus survival response curve (TMID). The first group is in the process of being evaluated for freeze

survival, while the second and third groups are in various stages of establishment and acclimation.

Preliminary results from the first group indicate a range in freeze tolerance from -5.0 C (Arizona Common) to -6.8 C (Riviera), with the five randomly chosen cultivars for this group exhibiting intermediate freeze tolerance. Freeze tolerance of newly seeded plants appears to be less than vegetatively propagated plants of the same cultivar evaluated in previous experiments. Similar observations have been reported in field-planted bermudagrasses experiencing natural freezes.

We are continuing to evaluate freeze tolerance of seeded bermudagrasses, with plants from the five groups cycling through establishment, acclimation, freeze exposure, and regrowth analyses. These experiments will be followed by freeze tolerance evaluations of vegetative entries. We will continue to conduct physiological studies of acclimation and injury mechanisms.

Summary Points

- Experiments are underway to evaluate freeze-tolerance levels of seeded bermudagrasses in the 2002 NTEP trial.
- Preliminary results from the first of five groups of seeded bermudagrasses show a range in freeze tolerance from -5.0 C (Arizona Common) to -6.8 C (Riviera).
- Freeze tolerance of vegetatively-propagated cultivars will be evaluated following studies with seeded bermudagrasses.