Bermudagrass Cold Hardiness: Characterization of Plants for Freeze Tolerance and Character of Low Temperature-Induced Genes

Oklahoma State University
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Start Date: 1998  
Number of Years: 5  
Total Funding: $125,000

Objectives:

1. Quantify cold hardiness of advanced breeding lines, recently released varieties, and established standard varieties using laboratory-based methodology.
2. Isolate and characterize genes corresponding to low temperature-induced and antifreeze proteins by constructing and screening a representative genomic library from MIDIRON with both homologous and heterologous gene probes.
3. Characterize the low temperature induced expression of the cloned genes by northern blot analysis.
4. Sequence the cloned genes and characterize gene structure and function based on nucleotide sequence data.

Library using a 300-bp cDNA bermudagrass clone provided by Mr. Stephen McLaugh from the University of Sydney, Australia, identified nine putative chitinase genes. Sequencing and homology studies completed for three of the clones provided strong evidence that they are indeed chitinase genes, which we designate as CynCht-1, CynCht-2, and CynCht-3. We expect all of the clones to also be chitinase genes.

Northern blot analyses indicated chitinase gene expression in MIDIRON, UGANDA, and MSU turf bermudagrasses to be strongly affected by acclimation temperatures (4-8 °C). Substantial increases (75-100%) in gene activity in crown and root tissues occurred after 24 hours of cold acclimation.

Increases of gene activity in crown and root tissues were proportional to the LT50’s and ploidy levels of the three cultivars. Cold acclimation for 28 days caused an approximate three-fold increase in chitinase gene activity in leaves of MIDIRON and UGANDA, but had little effect on MSU. Leaves of MSU remained relatively green during the 28 day acclimation, while those of MIDIRON and UGANDA strongly senesced.

Different Cor gene regulatory mechanisms may be involved in leaf and crown/root tissues.

Determining the Heritability of Salt Gland Density: A Salinity Tolerance Mechanism of Chloridoid Warm Season Turfgrasses

University of Arizona
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Start Date: 1998  
Number of Years: 3  
Total Funding: $55,815

Objectives:

Determine the broad and narrow sense heritabilities of salt gland density in zoysiagrass. Zoysiagrass is the ideal model system to determine salt gland heritability, as salt gland densities and relative salt tolerances of a large number of genotypes have already been determined. As salt gland density had been found to be an important salt tolerance mechanism in other turfgrasses in the Chloridoideae subfamily (i.e. bermudagrass, buffalograss) results should be applicable to these breeding programs as well.

For this project, Greg Wess was selected for the M.S. student position in the Department of Plant Sciences, having received his B.S. from our department last spring. After consulting with turfgrass breeders, and review of the literature, it was decided to limit the main polycross study to a wide selection of Zosysia japonica types. This was decided, based on recent findings from Sharon Anderson (Ph.D. student, Texas A&M University). First interspecific crossing between Z. matrella and Z. japonica types in zoysiagrass is possible, but often difficult and unpredictable. Second, flowering