

Development of Improved Turfgrass with Herbicide Resistance and Disease Resistance Through Transformation

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Goals:

- *Establish a transformation system for creeping bentgrass.*
- *Improve the utility of creeping bentgrass by incorporating genes to confer herbicide resistance or enhanced resistance to fungal pathogens.*

Cooperators:

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This project seeks to improve creeping bentgrass through genetic transformation to provide golf course managers with more effective and selective weed control with herbicides and more environmentally sound and cost-effective control of plant diseases with reduced use of fungicides. We have accomplished several major goals:

- 1) Development of a creeping bentgrass tissue culture and regeneration system
- 2) Successful biolistic and protoplast transformations of creeping bentgrass
- 3) Recovery of several cultivars of creeping bentgrass with resistance to two different herbicides
- 4) Field tests of clones of a herbicide-resistant creeping bentgrass
- 5) Turf quality (including disease resistance) study of herbicide-resistant transgenic creeping bentgrass
- 6) Progeny analysis of FinaleTM-resistant creeping bentgrass is underway.

Good progress was made incorporating single gene traits for herbicide resistance and enhanced disease resistance in turfgrass. We have expanded the creeping bentgrass tissue culture and regeneration system from nine creeping bentgrass cultivars to several other elite cultivars including PENNCROSS, PENNEAGLE, CRENSHAW, and A-1.

Transgenic creeping bentgrass clones of COBRA, EMERALD, and SOUTHSORE have been obtained from particle and protoplast transformation with resistance to FinaleTM herbicide (bialaphos). Greenhouse and field tests of herbicide-resistant creeping

bentgrass were conducted in 1994 and 1995. The screening tests indicate that the transgenic bentgrasses are resistant to five times the field rate in greenhouse herbicide spray tests and up to three times the recommended rate in field herbicide applications of Finale™.

Transgenic creeping bentgrasses from the 1994 field test were vernalized in the field over the winter and returned to a containment greenhouse in the spring before flowering. At flowering, they were cross-pollinated with wild type plants. Seed was harvested and progeny analysis was performed in the fall of 1995 to determine the heritability of the transgene.

Four field tests of herbicide resistant creeping bentgrasses were conducted in 1995. The COBRA transgenic plants obtained from protoplast transformation showed a high level of herbicide tolerance, up to three times the recommended field rate of Finale™, like the transgenic plants tested in the 1994 field test.

To enhance fungal disease resistance, we have performed greenhouse herbicide tests with putative transgenic plants that carry genes expressing bean chitinase, tobacco chitinase B and maize chitinase. These transgenic plants are now being tested for resistance to *Rhizoctonia solani* brown patch.