

Identification of the Colonial Bentgrass Contribution to Dollar Spot Resistance in Colonial x Creeping Bentgrass Interspecific Hybrids

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Objectives:

1. To construct a genetic linkage map for colonial bentgrass.
2. To identify the regions of the colonial bentgrass genome that confer dollar spot resistance to the colonial x creeping bentgrass interspecific hybrids.

Start Date: 2006

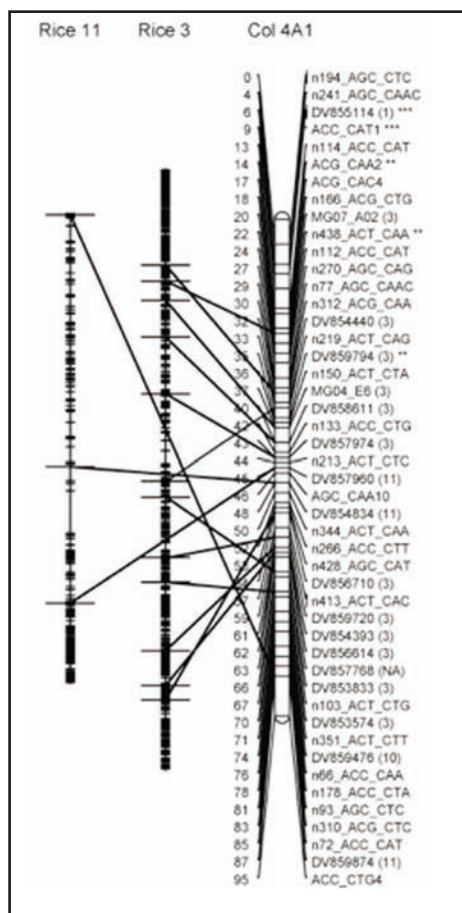
Project Duration: three years

Total Funding: \$90,000

Dollar spot disease is one of the major management problems encountered with creeping bentgrass. The related species, colonial bentgrass, has good resistance to dollar spot and may be a source of novel genes or alleles that could be used in the improvement of creeping bentgrass. Despite the dollar spot resistance of colonial bentgrass, creeping bentgrass is generally preferred because colonial bentgrass does not have the desirable aggressive stoloniferous growth habit of creeping bentgrass, which aids in repair of the turf from the damage incurred during play.

Interspecific hybridization has been used by breeders of many crops to introduce beneficial traits from related species into crop species. However, it has not yet been used in bentgrass breeding and so presents a great opportunity for creeping bentgrass improvement. The ultimate goal of such an approach would be to develop bentgrass cultivars with the stoloniferous growth habit of creeping bentgrass combined with the dollar spot resistance of colonial bentgrass.

For the past few years we have been investigating the possibility of using interspecific hybridization between colonial bentgrass and creeping bentgrass to introduce the dollar spot resistance of colonial bentgrass into creeping bentgrass. We have generated dollar spot resistant colonial bentgrass x creeping bentgrass interspecific hybrids. One of the hybrids was crossed with a creeping bentgrass plant and progeny were evaluated over two years for dollar spot resistance to assess the feasibility of introgression of dollar spot resistance from colonial bentgrass into creeping bentgrass. Of the 271 backcross genotypes in the test, 31 (11%) exhibited 20% or less disease, similar to the parental interspecific hybrid, in both



Colonial bentgrass linkage group 4A1. Most of the genes mapped to this linkage group are similar to genes on rice chromosomes 3 and 11.

years of testing. From this we can estimate that three colonial bentgrass genes may be required for the observed resistance.

One approach to eventual identification of genes conferring important phenotypic traits is genetic linkage mapping of a segregating population. We used 93 backcross individuals as the mapping population for genetic linkage mapping of the colonial bentgrass genome. This is the first genetic linkage map of colonial bentgrass. As part of the project, we generated colonial bentgrass expressed sequence tag (EST) resources that were used for mapping genes, and we developed a new method of marker identification called dideoxy polymorphism scanning. We used

the established rice-wheat chromosomal relationships to make the colonial bentgrass linkage group assignments. Most (81%) of the mapped ESTs conformed to the expectation of chromosomal location based on the location of the most similar genes in rice. The linkage map covers 1156 cM and it consists of 212 amplified fragment length polymorphic markers and 110 gene-based markers. Colonial bentgrass is an allotetraploid species ($2n = 4X = 28$, A1 and A2 subgenomes). The map consisted of the expected 14 linkage groups, which could be assigned to either the A1 or A2 homoeologous subgenomes.

To identify colonial bentgrass genomic regions conferring the dollar spot resistant phenotype, we searched for colonial bentgrass markers found in all of the resistant plants. A cluster of 14 markers on linkage group 2A1 and a single marker on group 3A1 were found in the resistant plants suggesting that these regions may be the chromosomal locations of the colonial bentgrass genes required for dollar spot resistance.

In the future it may be possible to develop molecular markers linked to the colonial bentgrass dollar spot resistance genes that could be used in marker-assisted selection.

Summary Points

- Colonial bentgrass is resistant to dollar spot disease. Hybridization with creeping bentgrass may be a way to improve the dollar spot resistance of creeping bentgrass.
- Field evaluations of the backcross progeny from a cross of an interspecific hybrid with creeping bentgrass suggest that three colonial bentgrass genes may be required for the observed dollar spot resistance.
- We developed the first genetic linkage map of colonial bentgrass. Our data suggests the colonial bentgrass dollar spot resistance genes may reside on linkage groups 2A1 and 3A1.