

Disease Resistant Bentgrass

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Introduction

Disease control continues to be a costly challenge for golf course superintendents requiring repeated fungicide applications throughout the growing season. One of the major diseases facing superintendents is dollar spot. The dollar spot fungus is becoming more resistant to all of the classes of fungicides. Dollar spot control often consumes a large portion of the fungicide budget. One means of reducing this cost, as well as overcoming the resistance problem, would be to have access to a disease-resistant bentgrass cultivar.

Several years ago, dollar spot resistant creeping bentgrass clones were found and collected from an old, segregated bentgrass green. These clones proved to be far more resistant to dollar spot than the most resistant commercial bentgrass varieties. These selected clones (MSU-2 and MSU-3) are being used to develop a dollar spot resistant bentgrass cultivar for commercial release. In the multi-year process of developing a cultivar, crosses are made, the resultant progeny are screened for the desired traits (disease resistance and other desirable agronomic characteristics) and the best progeny are selected to undergo further development.

During 2004, we established a space plant nursery on the MSU campus where we could backcross our most promising F₁ lines with the original disease-resistant parent lines and produce seed for future testing. After preparing the 8000 sq. ft. plot area and installing drip irrigation, 729 clones representing the two parent lines and our most promising progeny lines were planted in the nursery. Each year the nursery is hand weeded and sprayed with appropriate herbicides on a regular basis. Plants are fertilized as needed to maintain vigor. During the spring and early summer, the plants in the nursery cross with each other and set seed. By July, the plants produce seed which is hand-harvested by a crew of 4-6 workers over a period of approximately two weeks. This back-crossed F₁ seed is used to establish sod for annual field testing and evaluation of the progeny.

Corporate Partner Cooperative Research, 2005-06

Following the 2005 nursery seed harvest, the seed was hand-threshed and cleaned during the fall of 2005 and used to create sods in the greenhouse during the winter of 2005-06. This sod was transplanted to a putting green and a fairway on the Hancock Turfgrass Research Center in late 2006. This MSU back-crossed sod was evaluated regularly and compared to the corporate back-crossed F₁ sod that had been established on the Turf Center in 2005. The data

from these studies suggest that the MSU-generated F₁ back-crossed seed has a higher level of disease resistance than the corporate seed. Based on several year's data, the disease resistance in our lines exceeds the level of resistance in any resistant commercial variety.

DNA Fingerprinting

During the spring of 2006, the MSU Genomics Technology Support Facility notified us that they were unable to genetically distinguish between our bentgrass lines and other bentgrass cultivars based on current technology. Therefore, no AFLP fingerprints were obtained.

Field Research for 2007

Our field efforts over the next year will center on continued maintenance of our nursery, on-going evaluation of MSU- and corporate-generated F₁ back-crossed sods on the Turf Center. We are currently in discussions with our corporate partner regarding joint research projects that they may want to conduct during the next year, possibly utilizing additional MSU germ plasm and/or seed.

Genetic Research for 2006-07

While generating specific genetic fingerprints for our MSU lines appears to be unrealistic at this time, we do plan to investigate the genetic basis for the disease resistance expressed in our lines. This will be a multi-year, joint project between MSU, USDA, and possibly other universities which will help us to understand whether the resistance that is expressed in our material is genetically similar to that expressed in other university's resistant germ plasm. In order to do this, the initial steps toward development of a linkage map, which correlates a specific DNA marker with a resistance trait, will be initiated. This will provide a basis for comparison of MSU germ plasm with that from other universities to ensure that our resistance trait is novel. This process is highly labor-intensive and will likely involve many seeding/screening cycles over an extended period of time. This may establish a basis for intellectual property protection.

In this proposal we are seeking support for the continued screening and field testing of in-house and corporate-generated progeny. In addition, these funds will be used to produce the 150-180 progeny that will be screened and used in the initial steps in the development of a segregating population for use in creating a linkage map. This is the fourth year of a multi-year project with a long term goal of cultivar release in 5-8 years.

Objectives

Short term (1 year):

1. Initiate development of a segregating population by making crosses between resistant and susceptible, vegetatively propagated plants.
2. Field-testing of MSU-generated F1 progeny and other corporate-generated backcrossed disease-resistant progeny. (Completed in year 3, continuing in year 4).

Long term (5-7 years):

1. Release of a disease-resistant bentgrass cultivar for commercial use.

Budget

Year 4

Research Assistant (30% salary + fringes)	\$22,500
Supplies (biochemicals, planting supplies)	4,000
Total for year 3	\$26,500