

BREEDING BENTGRASS FOR DISEASE RESISTANCE

S.E. Warnke, B.E. Branham, and D.S. Douches

Department of Crop & Soil Science

Michigan State University

East Lansing, Michigan

The demand for high quality bentgrass seed has increased dramatically during the 1980's. These grasses have been bred for visual quality and adaptation to wear and temperature stresses. However, the public outcry over the use of pesticides to maintain these grasses and the development of fungal pathogens with resistance to currently available fungicides dictates that new breeding efforts be initiated to develop high-quality varieties with improved disease resistant.

Creeping bentgrass (*Agrostis palustris*) is one of the most disease-susceptible turfgrass species. The three cultivated species of bentgrass (creeping, colonial, and velvet) are all susceptible to dollar spot (*Lanzia spp.* and *Moellerodiscus spp.*), *Rhizoctonia* brown patch, *Helminthosporium* diseases, *Pythium* blight, *Typhula* blight, and *Fusarium* patch (Vargas, 1981). The lack of disease resistance in current bentgrass varieties requires that new sources of resistance genes be located and incorporated into newly developed varieties.

Disease resistance in plants can be classified into two categories, specific and general resistance. Specific resistance is easier for plant breeders to work with because it is controlled by a few major genes. However, specific resistance tends to be easier for the pathogen to overcome. General resistance tends to be more difficult for plant breeders to manipulate because it is controlled by several genes each having minor effect. However, general resistance is much more difficult for pathogens to overcome and is therefore more durable than specific resistance. In developing disease resistance in turfgrasses the durability of resistance is very important since turf is a perennial crop and replanting is not desirable. Therefore, breeding schemes which allow for the development of general resistance should be utilized when breeding bentgrass for improved disease resistance.

The breeding scheme most often utilized by turfgrass breeders to improve general resistance is termed recurrent selection. Recurrent selection is a cyclic procedure that involves screening a population of plants for resistance and selecting a percentage of the population with the highest resistance level to serve as the parent population for the next round of selection. This is a very effective method of breeding for disease resistance with the major drawback, in many cases, being the lack of efficient selection procedures. Currently available selection procedures require that the pathogen, host and correct environment all be present at the same time for disease to occur. Limitations can occur when the pathogen is difficult to culture or specific environmental conditions are needed for disease to occur. For example, in screening for resistance to dollar spot the fungus will only cause infection under conditions of high humidity which means that effective screening must take place in areas where the environment can be controlled such as a greenhouse or growth chamber.

One way to improve the efficiency of selection procedures is to take advantage of a genetic principle known as linkage. Genetic linkage means that if two traits are closely associated on the same chromosome they will be inherited together. Therefore, if one can locate genetic characters which are linked to genes for disease resistance a simple screen for the more easily scored genetic character implies that the gene for resistance is also present. The utility of this procedure is dependent upon the development of a large number of genetic markers throughout the genome of the plant species being studied. The development of powerful types of genetic markers such as isozymes, Restriction Fragment Length Polymorphisms (RFLPs) and Randomly Amplified Polymorphic DNA (RAPDs) has made this possible. Research is currently being initiated to establish useful linkages between genes for resistance to dollar spot and genetic markers with the goal of a more efficient method of breeding dollar spot resistant varieties.

The first step in the development of a more efficient selection procedure for dollar spot resistance is to isolate plants exhibiting some resistance to the disease. Currently a screening of approximately 4000 plants from 36 different varieties of bentgrass is being conducted to establish the level of resistance present. Concurrently research is being conducted with isozyme and RAPD markers so that resistant plants can be tested for linkages with these markers.

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