SCREENING BENTGRASS VARIETIES FOR RESISTANCE

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INTRODUCTION

Creeping bentgrass (*Agrostis stolonifera* L.) is a cool season turfgrass species primarily used for golf course putting greens and fairways. Dollar spot caused by *Sclerotinia homoeocarpa* Bennett, is a major disease of creeping bentgrass in areas where high humidity, prolonged leaf wetness and temperatures > 20 C occur. *S. homoeocarpa* causes straw-colored, sunken spots approximately 5 cm in diameter on creeping bentgrass. Foliar lesions are typically straw colored with brown margins. Endo et al. (1964) and Endo and Malca (1965) found a toxin associated with stunting and necrosis of bentgrass roots. The lack of pathogenicity at 10 and 32 C was associated with a lack of toxin production (Endo, 1963).

On golf courses in the temperate and hot humid regions of the United States more money is spent to manage dollar spot than on any other turfgrass disease (Vargas, 1994). In areas where frequent fungicide applications are practiced *S. homoeocarpa* has shown an ability to develop resistance to some of the DMI fungicides.

A practical means of slowing resistance to these fungicides and reducing fungicide application costs is to develop some genetic resistance in creeping bentgrass to this important disease. Reports are available from both inoculated and uninoculated variety trials that indicate there is no significant level of resistance in any of the currently available varieties (Colbaugh & Engelke, 1993) (Hsiang & Cook, 1993). Selection for resistance in field plantings can be misleading, because it is difficult to determine if a plant without disease symptoms is resistant or an escape. This problem is avoided by using artificial inoculations under controlled environmental conditions. The present study was initiated to determine the range of reaction to *Sclerotinia homoeocarpa* among and within creeping bentgrass varieties and to isolate the most resistant plants for use in a breeding program.

MATERIALS AND METHODS:

Seeds from 31 different bentgrass varieties were planted in flats containing 128 3.5 cm square pots filled with Bacto soil-less media. The flats were misted twice a day until plants reached the 3 leaf stage. The healthiest 100 plants were selected and watered as needed, fertilized monthly with a 20-20-20 soluble fertilizer, and clipped twice monthly.

S. homoeocarpa infested topdressing was prepared according to the method of Goodman and Burpee (1991). A mixture of sand and cornmeal (2:1) was placed in 30 x 40-cm aluminum baking pans lined with aluminum foil. The sand cornmeal mixture was smoothed to a depth of 1-cm in the baking pans and autoclaved at 121 C twice for 60 minutes then moistened to 6% (v/v) with 1% lactic acid in sterile deionized water. Three fungal colonies on 20ml of potato dextrose agar in 9-cm petri dishes were cut into 100-200 pieces and placed on the 1200cm^3 of sterile sand-cornmeal. After incubation for 2 weeks at room temperature the media was sliced and forced through a 2.5-mm mesh screen.

5 month old creeping bentgrass plants from 15 cultivars and 11 experimental varieties included in the 1993 National Turfgrass Evaluation Programs bentgrass variety trial plus 3 plant introductions and 2 colonial bentgrass varieties were tested. Varieties to be screened (Table 1) were split into two groups due to growth chamber space limitations. Each plant was topdressed with approximately 0.75g of infested sand cornmeal and then placed in a growth chamber. Controls of both uninoculated and inoculated plants with noninfested sand- cornmeal were included with each screening. The flats and

growth chamber walls were misted daily at 1700 h to increase relative humidity. The growth chamber was then shut down to eliminate air movement. The flats were maintained at 75 to 85% relative humidity and 25 to 30 C from 1700 h to 0900 h. Temperatures were 28 to 30 C and relative humidity 30-60% from 0900 to 1700. Disease pressure was maintained for seven days and each group of varieties received 2 inoculations to control for the possibility of escapes. Plants were scored for disease severity on a scale of 1-9 with 1 being a dead plant and 9 being no disease damage.

RESULTS

The results of the screening can be seen in Table 1. The range of scores was from 1 to 7 with 96% of the plants receiving a score of 1 (dead plant) or 2 (one or 2 surviving tillers). The average disease rating was a 1.4, indicating that overall disease pressure was very high. The inoculation procedure resulted in very uniform disease pressure based on visual observation of the level of mycelium growth on individual plants. 113 plants received a score from 3 to 7 and these plants were selected for further study. The variety DF-1 had the highest level of resistance with a mean score of 2.6 and 6 plants with a score of 6 or better. However, this variety was still heavily damaged by the disease with 73 plants having a score of 1 or 2.

DISCUSSION

The level of resistance exhibited by even the best performing varieties is still likely to translate into a high level of disease under field conditions due to the fact that 96% of the plant population shows little or no resistance to this pathogen. It is surprising that such a high percentage of the plants inoculated were killed by the pathogen (63%). One hypothesis for this response is that these plants are very susceptible to the pathogen produced toxin which has been previously reported.

This study appears to be the first report of a systematic screening of a collection of creeping bentgrass cultivars by artificial inoculation for reaction to this economically important disease. We believe that artificial inoculation is more reliable and convenient for screening for dollar spot resistance than dependence upon natural infection in the field. From this study we obtained an estimate of the disease reaction of a sampling of creeping bentgrass cultivars. These results provide a starting point in developing germplasm of *Agrostis stolonifera* with resistance to *Sclerotinaia homoeocarpa* that causes dollar spot on this important turfgrass species. The efficiency of selection for resistance to dollar spot could be improved considerably through the use of marker-assisted-selection. Therefore, future studies will be directed at establishing useful genetic linkages with genes from the bentgrass chromosomes influencing dollar spot resistance.

Table 1. Summary of dollar spot screening of 31 creeping bentgrass populations.

Mean Disease	Number of Plants in Each Class									Total Plants
Rating	* 1	2	3	4	5	6	7	8	9	Screened
1.4	1916	1019	26	56	22	7	2	0	0	3048
Range	Percent of Total in Each Class									Percent Selected
1.0-2.6	63	33	0.8	1.8	0.7	0.2	0.1	0	0	3.7
	* Disease severity rating on a 1-9 scale 1=dead 9=no damage									

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