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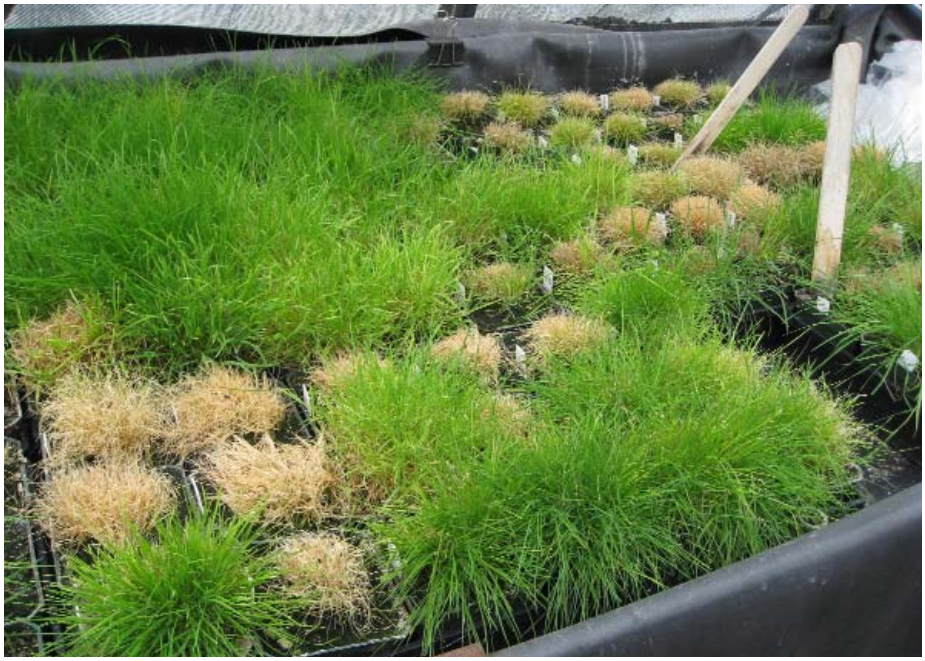

In a collaborative project, researchers at the University of Rhode Island and the University of Massachusetts screened the 250 accessions of the New England Velvet Bentgrass Collection for copper spot resistance. Sixty percent of the accessions tested were significantly more resistant than the standard varieties 'SR7200' and 'Greenwich', suggesting that development of resistant varieties should be possible.

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PURPOSE

The purpose of *USGA Turfgrass and Environmental Research Online* is to effectively communicate the results of research projects funded under USGA's Turfgrass and Environmental Research Program to all who can benefit from such knowledge. Since 1983, the USGA has funded more than 400 projects at a cost of $31 million. The private, non-profit research program provides funding opportunities to university faculty interested in working on environmental and turf management problems affecting golf courses. The outstanding playing conditions of today's golf courses are a direct result of ***using science to benefit golf***.

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Seeking Copper Spot Resistance in Velvet Bentgrass

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SUMMARY

Velvet bentgrass is significantly more resistant to dollar spot than is creeping bentgrass. However, this resistance does not permit turf managers to reduce fungicide use because velvet bentgrass is extremely susceptible to copper spot. Varieties with resistance to both diseases are needed in order to manage velvet bentgrass with fewer fungicides. We screened the 250 accessions of the New England Velvet Bentgrass Collection for copper spot resistance to determine if resistance was present. Sixty percent of the accessions tested were significantly more resistant than the standard varieties 'SR7200' and 'Greenwich' suggesting that development of resistant varieties should be possible.

- Copper spot, caused by the fungus *Gleocercospora sorghi*, is a major disease on velvet bentgrass that limits the grass' utility in hot summer regions.
- Current varieties are susceptible, but resistance is common among accessions collected from old golf courses in New England.
- Some accessions are resistant to both copper spot and dollar spot.

Velvet bentgrass is significantly more resistant to dollar spot than creeping bentgrass, and switching to velvet greens has been suggested as a way for turf managers to reduce fungicide use. However, velvet bentgrass is highly susceptible to the disease copper spot, which is less common on creeping bentgrass.

Copper spot is caused by the fungus *Gleoecercospera sorghi* Bain. The disease appears as small, rapidly multiplying copper-colored patches on turf mowed at greens height. Outbreaks can occur overnight when hot, humid conditions coincide with recent nitrogen fertilization. Fungal growth is triggered by high levels of the amino acid glutamine in plant exudates (1). The fungus overwinters as dormant sclerotia in the thatch, and spores are spread by water, equipment, and traffic.

Copper spot can be prevented with the fungicides used to prevent dollar spot, but that defeats the purpose of using a reduced-input grass. Use of organic fertilizers rather than synthetic nitrogen appears to reduce the risk of copper spot, but the disease can still occur under extremely favorable conditions (2). Velvet bentgrass that is resistant to both diseases would solve the problem. Unfortunately, all current velvet bentgrass varieties are susceptible. However, it is possible that resistance exists within the species, and that resistant varieties could be developed through breeding.

We tested this hypothesis by screening 247 accessions in the New England Velvet Bentgrass Collection for resistance to copper spot. The New

Copper spot disease damage on an SR7200/Greenwich velvet bentgrass green.

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England Velvet Bentgrass Collection is a set of over 250 accessions that were collected from eleven golf courses in Rhode Island, Connecticut, and Massachusetts and from naturally-occurring velvet bentgrass patches on the research farms at the University of Rhode Island and the University of Massachusetts. The collection is maintained at both URI and UMass, where the accessions have been evaluated for a variety of traits and are being converted to seed populations for long-term preservation and distribution through the USDA germplasm repository system.

Screening Methods

The accessions for screening were vegetatively propagated from tillers to create three clones of each accession. Clones were grown in 3-inch plastic pots filled with a 70:30 sand:peat mix. The commercial varieties 'Greenwich' and 'SR7200' were used as standards for comparison. Both varieties have been shown to be highly susceptible to copper spot in preliminary studies (3).

Plants were maintained with adequate water, fertilization and mowing at fairway height with a bench mower until the clones filled the pots. Screening was done in July using natural light. The *G. sorghi* isolate used for inoculation was originally collected from the Skogley Turfgrass Research Center in Kingston, RI and is maintained by the URI Turf Disease Diagnostic Lab. The fungus was subcultured on half-strength potato dextrose agar for three days at 90° F and stored at room temperature until needed.

Two weeks before inoculation, velvet bentgrass clones were fertilized with water-soluble synthetic fertilizer at a rate of 0.25 lb N/1,000 ft^2. One week later, clones received a second fertilization at 0.5 lbs N/1,000 ft^2. The final fertilization, also at 0.5 lbs N/1,000 ft^2, was applied immediately before inoculation. The plants were inoculated with *G. sorghi* by placing a 1-cm^2 slice of fungal culture directly in the center of each plant. Following inoculation, plants were maintained at 90° F and 75-85% relative humidity for

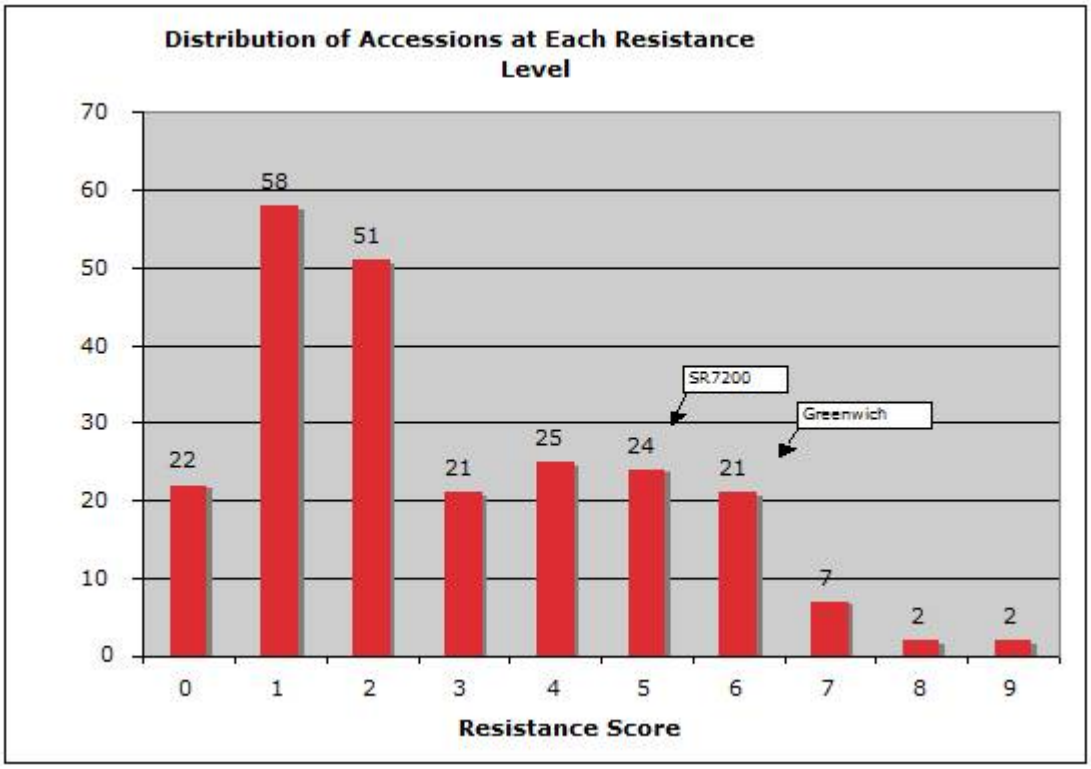

Figure 1. The frequency distribution of copper spot scores in 2008. Disease severity was rated on a 0-9 scale where 0 indicates no disease. Scores are the means of three replications.

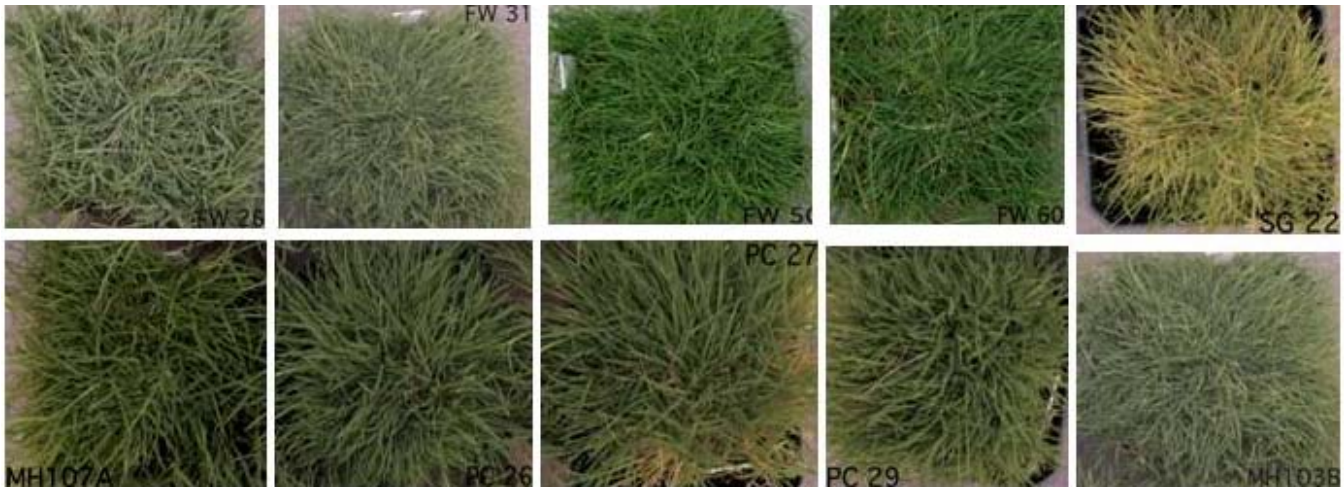

Figure 2. Ten velvet bentgrass accessions that showed resistance in both 2008 and 2009.

seven days to encourage fungal infection and growth. Disease severity was evaluated visually and rated using a 0-9 scale where 0 indicates no disease symptoms and 9 indicates completely infected foliage.

Pots were arranged in flats in the greenhouse in a randomized complete block design with three replications. The entire collection was screened in 2008. All accessions with high variation between the replications were re-screened in 2009 using newly propagated clones. We also re-screened a subset of the resistant clones, along with the two standards, to reconfirm resistance. Data were analyzed using analysis of variance followed by means testing using Fisher's Least Significant Difference.

Copper Spot Resistance in the New England Collection

The two standard varieties developed severe disease symptoms, as expected. In 2008 'Greenwich' had a mean score of 6.7, and 'SR7200' had a mean score of 5.2. The mean score across all accessions was 2.5 with a standard error of 0.0587. Sixty percent of the accessions tested showed acceptable resistance, with scores between 0 and 2.5. Only 23 accessions were more susceptible than the standards. All of the resistant accessions retested in 2009 scored between 0 and 1, while 'Greenwich' had a mean score of 6.7 and 'SR7200' had a mean score of 6.3.

Conclusions

Our results indicate that resistance to copper spot is common in velvet bentgrass collected from old greens. Thus it should be possible to develop resistant varieties through selection. We were not able to test copper spot resistance in our field nursery, as our coastal location is not conducive to prolonged hot, humid conditions.

However, the collection was evaluated for response to dollar spot in the field in 2009 and 2010 following natural disease outbreaks, and 39 of the accessions with resistance to copper spot also showed resistance to dollarspot. These accessions have been transplanted to a seed production nursery with the goal of developing a population that is resistant to both diseases. Use of copper spot resistant varieties combined with careful management of nitrogen fertility should permit superintendents and turf managers to maintain acceptable quality velvet bentgrass without preventative fungicide applications in areas where copper spot is problematic.

Acknowledgements

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