

Improving Dollar-Spot Resistance in Creeping Bentgrass

Rutgers University scientists investigate using colonial bentgrasses to incorporate dollar-spot resistance into creeping bentgrass.

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Creeping and colonial bentgrasses are important turfgrass species used extensively on golf course greens and fairways in temperate climates. Creeping bentgrass is generally preferred, in part, because of its aggressive stoloniferous growth habit. One of the most important maintenance problems with creeping bentgrass is dollar-spot disease, caused by the fungus *Sclerotinia homoeocarpa*. Fungal infection results in silver-dollar-sized dead areas in the turf that can coalesce to form large dead spots. No current cultivars are completely resistant to dollar spot, although recent releases show improved resistance.

Currently, dollar-spot disease control relies heavily on fungicide treatments, which can be expensive. Also, there is increasing pressure on many golf courses to reduce the use of pesticides. Although colonial bentgrass is not as widely used as creeping bentgrass, it generally does have good resistance to dollar spot and may be a source of genes that would be useful in improving the dollar-spot resistance of creeping bentgrass.

INTERSPECIFIC HYBRIDIZATION

Rutgers University has been working for several years on new approaches to improving dollar-spot resistance in creeping bentgrass. One approach that has been successful in other crops is interspecific hybridization, or crossing between two species. Usually there are biological barriers to such crosses, but

interspecific hybridization is frequently possible between two related plant species. Interspecific hybridization often occurs naturally and is believed to be one of the mechanisms that contributes to the generation of new species. Some important crops that originated from ancient natural interspecific crosses are wheat, oats, cotton, apples, and strawberries. In fact, many turfgrass species, including creeping and colonial bentgrasses, are believed to have originated from natural interspecific hybridization.

Modern-day plant breeders also have used interspecific hybridization. It is an attractive approach when a related species has a particular trait that is desired in the crop species. The standard method is to cross the crop species with a related species to produce an interspecific hybrid. This is followed by several generations of crossing back to the crop species, selecting those individuals that have the desired trait from the related species. For example, root-knot nematode resistance in many modern tomato cultivars originates from a gene in a wild species related to the cultivated tomato. Similarly, many modern wheat cultivars have some genes introduced from rye that contribute to disease and insect resistance.

HYBRIDS BETWEEN CREEPING AND COLONIAL BENTGRASS

Interspecific hybridization has not yet been used by bentgrass breeders. For the past several years, the possibility that this may be a useful new approach to

creeping bentgrass improvement has been explored. We are particularly interested in hybridization between creeping bentgrass and colonial bentgrass, since colonial bentgrass has good resistance to dollar spot. Also, these two species have the same chromosome number, 28, which makes interspecific hybridization more likely to be useful.

The first step was to evaluate the frequency of interspecific hybridization and the fertility of the hybrids that were produced by setting up controlled crosses in a greenhouse. To do this, colonial and creeping bentgrass plants were vernalized in the field in 1997. Some plants, including the bentgrasses, require a period of cold temperature and short days before flowering can occur. This process is called vernalization.

In the spring of 1998, plants were removed from the field, brought into the greenhouse, and controlled crosses were established. Flowers of a colonial bentgrass plant and a creeping bentgrass plant that were at the same developmental stage were bagged together in cloth bags. Seeds recovered from the colonial bentgrass plants were germinated, and some of the seedlings were confirmed to be interspecific hybrids, where pollen from the creeping bentgrass plant fertilized an egg from the colonial bentgrass plant. Overall, we found that hybrids between creeping bentgrass and colonial bentgrass could be produced at low frequencies.

The hybrids recovered were vernalized in the field in 1999 and analyzed for fertility in 2000. This was important



Turfgrass breeding efforts result in progeny that vary in appearance and susceptibility to disease.

because in order for interspecific hybridization to be a useful method, the hybrids need to have some level of fertility since it will be essential to cross the hybrids back to creeping bentgrass. The results indicated the hybrids were fertile, both through the pollen and the egg.

The next step was to determine if any of the colonial x creeping interspecific hybrids produced had improved dollar-spot resistance, relative to the creeping bentgrass parent. To do this, the interspecific hybrids and their creeping bentgrass parents were vegetatively replicated and planted, and the field was inoculated with the dollar-spot fungus. The plants were rated for disease severity at approximately weekly intervals throughout the season. In field tests carried out in 2001 and 2002, some of the interspecific hybrids exhibited excellent dollar-spot resistance. Similar results with these plants also were obtained in the 2003 field test.

These results were promising regarding the potential of interspecific hybridization in creeping bentgrass improvement. The next step was to cross an interspecific hybrid with a creeping bentgrass plant and evaluate the progeny of that cross for dollar-spot resistance. In 2002, one of the hybrids was crossed with a creeping bentgrass plant and about 1,000 progeny were obtained. These plants were field tested for dollar-spot resistance in 2003 and 2004. This population of plants is very interesting since there is a large variation in appearance among plants. Some plants resemble colonial bentgrass with a more upright growth habit, while others have the spreading, aggressive growth of creeping bentgrass. Plant susceptibility to dollar spot is varied, with some individuals having a similar level of dollar spot as creeping bentgrass and some having improved resistance.

Overall, interspecific hybridization between creeping and colonial bent-

grass looks like a useful method to introduce dollar-spot resistance to creeping bentgrass. We currently are involved in new studies to identify the genes in colonial bentgrass that are important for dollar-spot resistance.

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