



To Be or Not to Be Resistant!

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It is hard for me to visualize all of the propaganda golf course superintendents have to sift through. I imagine that most superintendents could fill a dumpster with all the product evaluations they receive. I see a lot of advertisements about disease resistant turfgrasses, but the question I keep asking myself is does this resistance equate to a reduction of fungicide applications. I think this is the question we should be asking ourselves. Why? Yes cultivars of turfgrass do differ with respect to resistance to important pathogens, yet no cultivar to my knowledge is immune. The rebuttal to the aforementioned statement, is why use the word resistant.

Plant resistance is defined as the ability to delay or prevent infection. This definition allows for a continuum of resistance that spans slight delays in infection to complete immunity. In particular the hot topic with host resistance for golf courses is the introduction of cultivars possessing enhanced resistance to the dollar spot fungus. What is the mechanism/s of resistance for these newer creeping bentgrass cultivars?

A study conducted by Stacy Bonos at Rutgers University, evaluated the physical properties associated with increased levels of dollar spot resistance. She found that cultivars with enhanced dollar spot resistance had larger and significantly more trichomes (leaf hairs) than those cultivars with lower levels of dollar spot resistance. These leaf hairs act as a physical barrier to the fungus, which only impedes the infection process. In no way am I trying to diminish the accomplishment of turfgrass breeders with respect to dollar spot resistance, but we still have some more progress to make.

These newer cultivars (Memorial, Declaration, 007, etc.) do demonstrate increase levels of resistance to the dollar spot fungus, but dollar spot eventually still develops on these cultivars. Although dollar spot still develops on these cultivars, they are marketed as means to reduce fungicide inputs. Yet, golf course superintendents have to maintain a certain aesthetic and playability standard that may not be attainable with limited fungicide inputs even with a resistant cultivar. The questions that remain are: 1. Will deployment of creeping bentgrass cultivars with enhanced dollar spot resistance reduce fungicide inputs? and: 2. What genetic mechanisms govern dollar spot resistance?

Paul Koch is working on a project to answer question one. He has planted eight creeping bentgrass cultivars (Memorial, Declaration, Pennncross, Penn A-1 and A-4,



Figure 1. Relative resistance among creeping bentgrass cultivars planted at Eagle River Golf Course in Eagle River WI. Pennncross is the cultivar on the left and Declaration is the cultivar on the right.

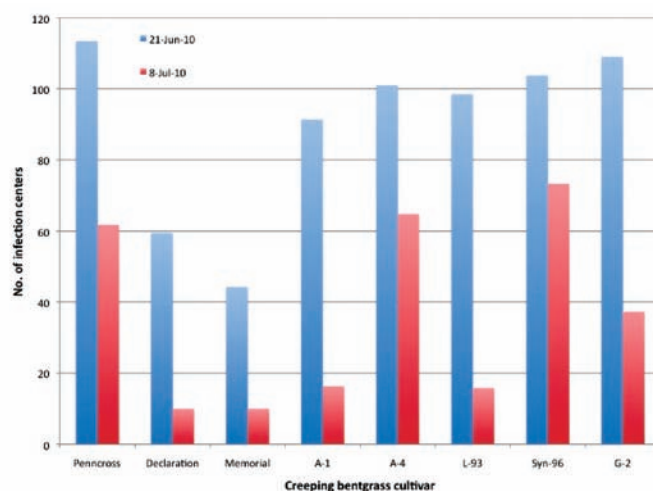


Figure 2. Relative resistance of eight creeping bentgrass cultivars to the dollar spot fungus *Sclerotinia homoeocarpa*. Blue bars represent the number of dollar spot infection centers per plot on June 21, 2010 and red bars represent the number of dollar spot infection centers per plot on July 8, 2010. Fungicides were applied on June 21 and July 9, 2010, which explains the decrease in dollar spot developed between the two rating dates.

Syn-96, L-93 and G-2) at Eagle River Golf Course in Eagle River, WI and at the OJ Noer in Madison. We are evaluating snow mold resistance in Eagle River and dollar spot resistance in Madison. This trial was planted last summer, so we have limited data so far. However, what we do have is promising. It appears that the culti-

vars touting dollar spot resistance are also more resistant to snow mold fungi (Figure 1). The picture demonstrates snow mold development when sprayed with half rates of Instrata and clearly the dollar spot resistant cultivar in the picture (Declaration) has far less snow mold. This was surprising because very few cultivars of bentgrass display differences when placed under intense pressure.

Memorial and Declaration are marketed as creeping bentgrass cultivars possessing enhanced dollar spot resistance, which is supported by our initial data (Figure 2). Yet when we calculate the area affected within each plot regardless of cultivar, using a resistant cultivar does not provide acceptable levels of dollar spot control (<5% disease). However, all of these plots have only received two fungicide applications to date. On the second rating date on July 8, 2010, dollar spot intensity was greatly reduced in some creeping bentgrass cultivars even after a fungicide application. So far these data indicate that planting a dollar spot resistant cultivar maybe an effective method for reducing fungicide inputs.

We will attempt to answer the second question by using molecular tools. A colleague in our department, Andrew Bent, is an expert on host plant defense mechanisms and genetics. We are going to work with Dr. Bent to elucidate the mechanisms that may contribute to dollar spot resistance. We are planning on inoculating large populations of a model plant called *Arabidopsis thaliana*. This plant is a dicot with a very small genome that will allow us to rapidly look at many different genotypes. Basically we can order different genotypes of this model plant and inoculate with the dollar spot fungus. After many screenings we can identify genes that may confer resistance to the dollar spot fungus. The main disadvan-

tage to this system is the plant is a dicot therefore the genes may not exist in monocots. Yet, it is still a good starting point.

Once we have identified genes that moderate resistance to dollar spot, we can then screen existing creeping bentgrass cultivars as well as other grasses such as velvet bentgrass and even rice for these genes. Our goal is to find a gene or genes that convey dollar spot resistance that can be transferred to creeping bentgrass. Furthermore, we can use tools to characterize the gene products responsible for conveying dollar spot resistance.

You are most likely wondering why any of this gibberish I just wrote is important. The main value is for breeders. As plant pathologists understand host resistance using models or molecular tools, specific markers could be devel-

oped to screen future turfgrass cultivars for dollar spot resistance. A specific marker for dollar spot resistance could facilitate the release of future creeping bentgrass cultivars.

Disease resistance was not a focus of turfgrass breeding programs in the past. Breeders focused primarily on agronomic qualities such as leaf texture, color, and density. Once cultivars were released with improved agronomic qualities breeders then started focusing on heat and drought tolerance. Only recently have breeders begun focusing on disease resistance, especially in populations of creeping bentgrass. Breeding for disease resistance is paramount if turfgrasses are to remain the dominant urban plant. The turfgrass pathology program at UW Madison intends to help that effort anyway we can. 🌱

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