Brown patch - a different perspective

by Christopher Sann

Unlike many other turfgrass diseases, brown patch seems to stubbornly resist the many attempts to expand effective control strategies, other than the treatment with fungicides. The many other cultural and management practices used to control the severity of other foliar turfgrass diseases have not proven to be successful. Perhaps some of this is due more to a failure to understand the biology of the disease.

The common perception among turfgrass managers, that brown patch is a very common disease similar to other turfgrass diseases only more difficult to control, is a conclusion based on their observed experiences and is inaccurate. To be sure, *Rhizoctonia solani* is a difficult pathogen to control, but the idea that it is analogous to the other common diseases, such as leaf spot, is not correct. Actually *Rhizoctonia solani* is analogous to grey snow mold in its biology and to the root-damaging pathogens in the timing and expression of symptoms.

Dr. Gary Yuen and his associates at the University of Nebraska have recently released the results of several studies of the biology of *Rhizoctonia solani* on stands of tall fescue. These studies examined various aspects of the specific biology of *Rhizoctonia solani* and how the mechanical structure of a host contributed to the development and expression of disease symptoms. Dr. Yuen's work was primarily focused on four areas:

- Investigation of the correlation between observed laboratory resistance in several tall fescue varieties and actual field resistance of those varieties to *Rhizoctonia solani*
- The influence of the turfgrass canopy's structure and environment on the spread of *Rhizoctonia solani*
- The distribution of *Rhizoctonia solani* in asymptomatic portions of turfgrass stands at or near infection locations
- The possible biological control of *Rhizoctonia solani* using fungal antagonists.

Dr. Yuen's findings, particularly on the role of the canopy structure in the spread of the disease, should begin to provide a sharper picture of the biology of *Rhizoctonia solani* on turfgrasses and may lead to new strategies for dealing with this pathogen.

Laboratory versus field resistance

For many of the diseases of turfgrass there has been an assumed correlation between the measured genetic resistance of a turfgrass variety to a pathogen and subsequent resistance of that variety to the same pathogen in the field.

Table 1

How genetic and field resistance relate

Cultivar	% Blighted (genetic)	Rank	% Blighted (field)	Rank
K-31	18%	1	34%	1
Monarch	30	2	46	4
Apache	37	3	52	7
Silverado	38	4	44	3
Pacer	40	5	52	8
Trailblazer	40	6	60	9
Wrangler	42	7	48	6
Tribute	42	8	43	2
Rebell II	50	9	48	5

This was not the case for the *Rhizoctonia solani* infestations of the six varieties of tall fescue that Dr. Yuen studied in 1993.

In one study, three of the six varieties of tall fescue that were raised in growth chambers were identified as having genetic resistance to *Rhizoctonia solani,* while the other three did not. When these varieties were placed in the field plots and the plots were inoculated with *Rhizoctonia solani,* the six varieties did not show results that correlated to the results from the growth chamber testing. For example, in the field, the most resistant variety of tall fescue had previously been classified as susceptible and the second most susceptible variety had been considered to be a resistant variety.

Table 1 shows the results of another study and the relationship between the genetic resistance and the field resistance of nine tall fescue varieties.

Leaf density is correlated to disease severity

Since tissue resistance to *Rhizoctonia solani* did not strongly correlate (only a 30% to 40% correlation was found) to the actual field resistance, the researchers looked for additional factors. Dr. Yuen found that there is a strong (70% to 80%) correlation between a narrow leaf blade width with its subsequent higher leaf densities and increased *Rhizoctonia solani* disease severity in tall fescue.

A 1994 study found that the varieties with the lowest weight per leaf (narrowest) had the highest levels of disease and the varieties with the highest weight per leaf (widest) had the least amount of disease. Table 2 lists the same cultivars as Table 1 with the average weight per each leaf and the disease severity for that cultivar.

The data from a second study of seeding density and disease development more graphically demonstrated the very high correlation between blade density and disease severity. The tall fescue cultivar "Fawn", previously identified as being very susceptible to *Rhizoctonia solani* infection, was seeded at three different seeding rates: 10, 30, and 50 grams per square meter. The seeded plots were inoculated, and then evaluated for average lesion ratings over a one-month period beginning 20 days after inoculation. Over the period of the study, the average number of leaves increased 63% as the seeding rate increased from 10 to 30 grams, while the lesion rating (disease severity) increased 56%. The number of leaves increased 21% as the seeding rate increased from 30 to 50 grams and the lesion rating increased 29%.

Table 2

Leaf weights and disease severity

Cultivar	Rank*	Rating**	Rank	Weight***	Rank
K-31	1	3.4	1	.0123	1
Tribute	2	5.3	6	.0083	4
Silverado	3	5.0	4	.0075	6
Monarch	4	5.6	8	.0076	5
Rebell II	5	4.9	2	.0074	8
Wrangler	6	5.4	7	.0066	9
Apache	7	5.3	5	.0084	3
Pacer	8	5.0	3	.0089	2
Trailblazer	9	6.1	9	.0074	7

* Ranking based on % blighted, field ranking from Table 1
** Rating 0-10, 0 = no lesions, 10 = most lesions
*** in grams (verdue weight/# of leaves = leaf weight), ranked greater to lesser
(Authors note: Table 2 is the result of calculations made by the author, using Dr. Yuen's data.)

Logically, the leaf to leaf transfer of the vegetative or hyphael matter that occurs with this and other *Rhizoctonia* pathogens of turf would be substantially enhanced by the increases in stand density that often come from narrower leaf blades. When the number of potential food sources, the leaves, per given area is increased by as much as a factor of one, by going from the wider leaf blades of older cultivars to narrower leaf blades of the newer varieties, then the potential for contacts between infected leaves and uninfected leaves, caused by wind or mechanical means, will dramatically increase and hence the potential for disease spread will dramatically increase.

The increased tendency of the newer hybrid tall fescue varieties to suffer from increased levels of *Rhizoctonia solani* had been observed by turfgrass managers and has been the subject of a number of complaints.

Dr. Yuen's identification of this purely mechanical method of disease movement for *Rhizoctonia solani* opens up the possibility that other non-biological factors can play significant roles in the spread of this and other diseases within the turfgrass canopy and that these factors are contributing to greater disease severity. Similar field observations for other diseases and hosts, such as the aforementioned increased incidence of *Rhizoctonia solani* infestations in newer cultivars of tall fescue, should lead to a thorough examination of other turfgrass diseases, their host's structure, and an examination of the effects of these non-biological factors on the course of symptom development.

Dr. Yuen said that this information also raises the strong possibility that future field studies to identify disease resistance for *Rhizoctonia solani* and other diseases in the many turfgrass varietal trials that are conducted will require that stands be of equal leaf densities prior to being rated for field disease resistance so that the varieties can be rated on an equal basis.

The asymptomatic distribution of R. solani

Dr. Yuen also studied the distribution of the *Rhizoctonia solani* pathogen on the leaves, in the thatch, and on the roots of asymptomatic bentgrass turf collected from areas immediately adjacent to infected locations.

The study, which used two methods of identifying the pathogen, established that the pathogen could be found in significant numbers and on a consistent basis on the leaves of asymptomatic bentgrass turf for a distance of up to 12

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inches from the edges of existing disease patches. To a lesser extent the pathogen could be also identified as being present in the thatch of asymptomatic areas, but, contrary to isolated reports, it was not present in the roots of the same plants. This study confirmed that the *Rhizoctonia solani* pathogen is primarily concentrated on turfgrass foliage surfaces and that it can exist there in substantial numbers in an area that appears asymptomatic. The data from this study should provide the basis for further studies that attempt to formulate new control strategies. Additionally, this information bolsters the argument used in the already existing practice aimed at reducing the periods of leaf gutation by syringing with water and the applications of wetting agents to turf foliage.

Biological controls are studied

Dr. Yuen also conducted a study of two promising strains of antagonistic fungi, one a non-pathogenic, binucleate form of *Rhizoctonia* and the other an isolate of *Giocladium virens,* to see if the suppression of *Rhizoctonia solani* demonstrated in the lab would transfer into the field. In the lab, the binucleate *Rhizoctonia spp. (GM 460)* had reduced expression on tall fescue seedlings by 74% and the *G. virens (TRBG)* strain had reduced symptoms by 40%, when rated 10 days after the introduction of the pathogen.

In a field test of the GM 640 strain, one application, consisting of colonized millet seed, made one week before the introduction of the pathogen, reduced the level of disease expression by 46% 27 days after inoculation. When a second application of GM 640 was made at the time of the inoculation the disease expression was reduced by 63%, just a few percentage points short of the rating set for the uninfested control plot in the study.

When both strains were applied singly, at multiple rates, and mixed, they showed only marginal improvements in disease suppression over the two months of the study. Single and multiple applications of GM 640 were slightly better at disease suppression than the corresponding applications of TRBG. But the combination applications of triple rates of both strains produced results that averaged a 37% reduction in disease severity compared to the untreated inoculated control over the nine weeks of the test. Also the disease reduction averaged 49% when the turf was rated 7 to 10 days after each application.

The results of these tests produced good and bad news. The good news was that at least one strain, GM 460, could survive on leaf surfaces for periods longer than 30 days thereby approximating existing fungicide reapplication schedules. The bad news was that the level of disease control of these two strains did not approach the commercial threshold of 80%. ■

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