

## RESEARCH

# Cool-season grass response to rapid blight disease

Field observations of rapid blight were confirmed in the lab.

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Rapid blight, a new disease that affects cool-season turfgrass, is active primarily in geographical and climatological areas where warm-season turfgrasses are the best-adapted species. When used for fall overseeding, cool-season grasses also have become infected with this new pathogen. Rapid blight seems to be associated with saline soils, high salt content in irrigation water, or both. These conditions are common in the southwestern United States, where rainfall is limited and the use of water sources with high salt content continues to increase.

At first, rapid blight was thought to be caused by a fungal-like organism, called a chytridiomycete. It is now known to be caused by a *Labyrinthula* species, which, until recently, was thought to infect only ocean plants. Because this is a land-dwelling species, it has been named *L. terrestris*.

### Disease symptoms

Symptom expression has been documented in arid, semi-arid and humid regions of the United States. After overseeding, symptoms can appear throughout the juvenile development of the overseeded turf, but often develop at the time of the first mowing. In the initial stage of disease, leaves of affected plants have a water-soaked appearance, and symptoms develop in small, irregular patches. Subsequent visual symptoms include an initial appearance of stunted growth, off-color grayish shoots or leaves, and partial collapse of the turf, followed by a loss of turf density five to 10 days after initial symptoms appear.

When the disease progresses rapidly, chlorosis (turf yellowing) may not be evident. Disease symptoms usually occur in patches that range in size from 5 to 8 inches (12.7-20.3 centimeters) in diameter and can overlap each other, forming large areas of poor-quality turf (Figure 1).

When used as preventive applications,



Photo courtesy of M.W. Olsen

**Figure 1.** Rapid blight has caused the partial collapse of this plot of *Laser Poa trivialis*.

Fore (mancozeb) and Compass (trifloxystrobin) fungicides to date have shown the most activity against rapid blight.

### The experiment

The most popular cool-season grasses used to overseed bermudagrass greens are perennial ryegrass (*Lolium perenne*) and rough stalk bluegrass (*Poa trivialis*). Both grasses have shown moderate to severe rapid blight symptoms, and lab tests have confirmed the presence of *L. terrestris*. The host range of rapid blight is not known among cool-season grasses.

A two-year experiment was devised to determine the susceptibility and disease expression of selected species and cultivars to rapid blight in the field and to determine

whether there was a correlation between visual identification of rapid blight in the field and confirmation of the disease in the laboratory.

The field plots were located in central Arizona at Estrella Mountain Ranch Golf Club, Goodyear, Ariz., which has a known history of rapid blight.

### Materials and methods

We selected several cool-season turfgrass species for overseeding a Tifdwarf putting green nursery at Estrella. Irrigation water quality at the site includes TDS (total dissolved salts) values of 1,900 to 3,000 ppm (averaging 2,400 ppm), and sodium levels of 500 to 800 ppm. Average rainfall ranges from 4.0 to 5.0 inches (10.2-12.7 centimeters).

## Cultivars

The 15 entries of overseed grass types in the experiment included: perennial ryegrass; *Poa trivialis*; intermediate ryegrass; velvet, red top and creeping bentgrass; chewings and hard fescue; and tufted hairgrass. Cultivars and seeding rates are listed in Table 1.

## Experimental plots

The Tifdwarf bermudagrass putting green nursery was overseeded in mid-October 2002 (year 1) and in early October 2003 (year 2). Plot size was 3 feet by 5 feet (0.9 meters by 1.5 meters). Each grass was replicated four times in a randomized complete block design. After hand-seeding in closed cages, the plots were topdressed with  $\frac{3}{16}$  inch (0.5 centimeters) sand and irrigated to promote seedling emergence. The test plots were mowed for the first time approximately 12-14 days after overseeding at  $\frac{3}{8}$  inch (9.5 millimeters). Mowing height was gradually lowered during fall until a height of  $\frac{1}{8}$  inch (3.2 millimeters) was achieved by late December.

## Visual ratings

Disease symptoms were evident after the first mowing, and plots were rated monthly throughout the season for disease incidence and severity of expression. Visual ratings were taken on a 1-9 scale, where 1 = dead turf, and 9 = no disease symptoms. Lower scores reflect increased degree and expression of the disease across the turf. Scores of 6-9 indicate no visual disease expression, and ratings of 5 or less indicate increased expression. Plots were rated by a turf agronomist and a pathologist, and the average was used for statistical analysis.

## Laboratory identification

In year 1, two to three plug samples were taken from symptomatic areas. Leaf blade tissues from these samples were dissected into thin sections, viewed under a microscope and scored (yes/no) for the presence or absence of *L. terrestris* cells. In year 2, three to five turf samples were taken periodically from each plot throughout the fall and early winter, whether or not symptoms of disease were present.

These samples were taken to the laboratory for detection of *L. terrestris*, and selective media were used to isolate the organism. An average of 30 tillers were plated per sample; we counted the number of colonies that grew from the tillers. From these data, we calculated a percentage of infection (the number of infected tillers divided by the total number of tillers).

## Data analysis

We used statistical analysis to compare differences among cultivars for visual symptoms of disease in the field and for lab detection of the disease from the field samples. To determine whether the field observation of disease was related to lab detection of the causal organism, we gave each field plot a score of 1 (yes, disease symptoms are visible) or 2 (no, disease symptoms are not visible). If the presence of *L. terrestris* in a field plot was confirmed by laboratory tests, the result was rated "positive"; if not, the result was rated "negative." The results of the field plot scores and the laboratory findings were then compared.

## CULTIVARS AND SEEDING RATES

Cultivar	Type	Latin name	Seeding rate (pounds PLS/1,000 square feet)*
Fult's	alkaligrass	<i>Puccinellia distans</i>	8.1
Dawson	slender creeping red fescue	<i>Festuca rubra var. rubra</i>	30.1
SRX 555	slender creeping red fescue	<i>F. rubra var. rubra</i>	30.1
SR 5100	chewings fescue	<i>F. durisculoa</i>	30.1
SR 5210	slender creeping red fescue	<i>F. rubra var. rubra</i>	30.1
SR 3100	hard fescue	<i>F. duriscula</i>	30.1
TransEze	intermediate ryegrass	<i>Lolium hybridum</i>	40.4
SR 4420	perennial ryegrass	<i>L. perenne</i>	40.4
Providence	creeping bentgrass	<i>Agrostis palustris</i>	4.0
SR 7200	velvet bentgrass	<i>Agrostis canina</i>	3.1
SR 7100	colonial bentgrass	<i>Agrostis tenuifolia</i>	4.0
Laser	rough stalk bluegrass	<i>Poa trivialis</i>	8.1
Sabre II	rough stalk bluegrass	<i>P. trivialis</i>	8.1
Red top	red top	<i>Agrostis alba</i>	4.0
SR 6000	tufted hairgrass	<i>Deschampsia ceaspatosa</i>	7.3

\*PLS = pure live seed.

**Table 1.** Overseed entries and seeding rates evaluated for response to rapid blight when maintained at putting green heights, 2002-2004, University of Arizona.

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## First-year results, 2002-2003

In the first year, the overseed grasses exhibited a considerable range of responses for symptom expression of rapid blight in turf plots. The number of plots suspected of having diseased turf ranged from none of the four replicate plots to all four replicate plots showing positive detection (Table 2).

Dawson and SRX 555 SLQ showed no plot symptoms in year 1, and no *L. terrestris* cells were seen by microscope for these two varieties. Although one plot of SR 5210 slender creeping fescue was visually identified as having symptoms of *L. terrestris* infection, it was not confirmed in the lab.

Five entries showed *L. terrestris* symptoms in one of the four replicate field plots. These included Fult's alkaligrass, SR 5210 slender creeping red fescue, Providence creeping bentgrass, red top and SR 6000 tufted hairgrass (Table 2). The tufted hairgrass did not establish well either from poor seedling emergence, intolerance of close mowing or both. All other overseed entries were positive for disease expression; for either three or all four of

the replicated field plots, *L. terrestris* was identified by microscope.

SR 7200 velvet bentgrass and SR 7100 colonial bentgrass developed high rates of disease symptoms in the field, which were detected in the lab. Laser and Sabre II *Poa trivialis*, red top, SR 4420 perennial ryegrass and TransEze intermediate ryegrass entries also were highly infested in the field, and *L. terrestris* cells were easily seen by microscope in the lab.

The expression of disease symptoms was observed to reach its peak by mid-December of the first year as the extended juvenile period of overseed turf began to close and cold weather slowed growth. After mid-December, no new disease symptoms were evident, and recovery from disease was minimal.

## Second-year results, 2003-2004

The plots were overseeded with the same grass species and cultivars as in the first year. Disease development occurred later in the year (December 2003) and peaked in January 2004. Sporadic natural rainfall in November decreased disease symptoms (perhaps because

of natural leaching of salts in the soil profile).

As in the first year, a diverse response occurred in field expression and lab detection among overseed entries. Disease pressure was again adequate in 2003-2004. In the second year, field sampling from early December to the end of January (when disease expression was highest) resulted in more positive laboratory identifications of *L. terrestris* than in the first year. More plots also showed visual rapid blight-type symptoms in year 2. In year 2, all plots in the field eventually showed some disease expression.

The lowest visible disease expression occurred on plots of SR 5100 chewings fescue (1.5 field incidence) (Table 2). For all other cultivar entries, either three or all four replicate plots exhibited some disease expression by the end of January 2004. More instances of positive detection of *L. terrestris* occurred in year 2 when lab plates were used than in year 1 when leaf pieces were viewed under a microscope.

## Tiller infection rates

The final seasonal percentage of tiller infec-

## CULTIVARS VS. DISEASE

Grass	Year 1			Year 2					
	No. plots suspected as field diseased	Mean field plot scores*	Lab detection from field sample	No. plots suspected as field diseased	Mean field plot scores*	Lab detection from field sample	No. lab plates testing positive	Tiller infection (%)	Visual disease field rating†
Fult's alkali	1 of 4	1.8	positive	3 of 4	1.3	positive	3 of 4	6	5.5
Dawson creeping red fescue	0 of 4	2.0	negative	3 of 4	1.3	positive	3 of 4	4	9
SRX 555 SLQ slender creeping red fescue	0 of 4	2.0	negative	3 of 4	1.3	positive	1 of 4	2	7
SR 5100 chewings fescue	3 of 4	1.3	positive	2 of 4	1.5	positive	3 of 4	21	5.5
SR 5210 slender creeping red fescue	1 of 4	1.8	negative	3 of 4	1.3	positive	4 of 4	10	7
SR 3100 hard fescue.	4 of 4	1.0	positive	3 of 4	1.3	positive	4 of 4	18	4
TransEze intermediate ryegrass	4 of 4	1.0	positive	4 of 4	1.0	positive	4 of 4	41	4
SR 4420 perennial ryegrass	4 of 4	1.0	positive	3 of 4	1.3	positive	4 of 4	56	5
Providence creeping bentgrass	1 of 4	1.8	positive	4 of 4	1.0	positive	3 of 4	16	8.8
SR 7200 velvet bentgrass	4 of 4	1.0	positive	4 of 4	1.0	positive	4 of 4	71	3.5
SR 7100 colonial bentgrass	3 of 4	1.0	positive	3 of 4	1.3	positive	4 of 4	39	4.5
Laser <i>Poa trivialis</i>	4 of 4	1.0	positive	3 of 4	1.3	positive	4 of 4	75	2.5
Sabre II <i>P. trivialis</i>	4 of 4	1.0	positive	4 of 4	1.0	positive	4 of 4	80	3.2
Red top ( <i>Agrostis alba</i> )	1 of 4	1.8	positive	4 of 4	1.0	positive	4 of 4	7	5.7
<b>Date average‡</b>		<b>1.4</b>			<b>1.2</b>			<b>31</b>	<b>5.3</b>

\*Mean field plot scores. Plots were scored for the presence of disease symptoms: Yes = 1; No = 2. Values are the mean of four plots/treatment.

†Visual field disease rating on a scale of 1-9, where 1 = dead, and 9 = best possible turf. Lower values indicate greater disease. Values are the mean of four plots/treatment.

‡Date average = mean of all treatments. Values are the mean of 60 observations.

**Table 2.** Mean grass disease scores, number of plots showing suspected disease symptoms and lab detection of *L. terrestris* after overseeding Tifgreen bermudagrass with various cool-season grasses, Estrella Mountain Ranch Golf Club, University of Arizona, fall 2002.

tion rates (the number of infected tillers divided by the total number of tillers per plate) was highly significant for species and cultivar. Mean tiller infection rates were 80% for Sabre II and 75% for Laser *Poa trivialis*, whereas SR 7200 velvet bentgrass averaged 71% tiller infection and SR 4420 perennial ryegrass averaged 56% tiller infection. Average infection values were 4% for Dawson creeping red fescue CQF and 2% for SRX 555 SLQ.

We explored the relationship between the field disease index values and the tiller infection rate by comparing field scores and lab results. Under moderate to severe infection levels, turf response in the field is generally related to the amount of the *L. terrestris* organism isolated from the tillers on selective media in the lab.

### Field detection vs. lab identification

We also measured the association between visual identification of disease in the field versus *L. terrestris* detection in the lab. A total of 59 plates were compared to their respective (60) field plots for presence of disease. In 50 of 59 cases, there was agreement between the presence of disease in the field and identification of the disease in the lab. In 49 of these 50 cases, positive identification in the lab was paired with positive disease expression in the field.

Only nine of 59 cases were in disagreement. In five of these, field plots showed symptoms, but the lab samples were negative for *L. terrestris*. (The occasional presence of other secondary fungal pathogens found on these samples indicates that the appearance of symptoms is most likely an artefact of poor tolerance to close mowing.) In the remaining four of these cases, *L. terrestris* was detected in the lab, but disease symptoms were not detected visually in the field.

This research demonstrated that field observations can be used for assessing the visible expression of rapid blight, which was confirmed by laboratory analysis. These findings also show that there is variation among grasses included in this test for the visual field expression of rapid blight symptoms caused by *L. terrestris*.

### Conclusions

- Over a two-year period, rapid blight, caused by *L. terrestris*, was capable of infesting most of the 15 cool-season cultivars included in this test.

## THE RESEARCH | says . . .

- ▶ **Rapid blight**, a new disease affecting cool-season grasses, is associated with saline soils and/or high salt content in irrigation water. It occurs where warm-season grasses are the best-adapted species and cool-season grasses are used for overseeding.
- ▶ **In the first year**, Dawson creeping red fescue, SRX 555 SLQ slender creeping red fescue, and SR 5210 slender creeping red fescue showed no signs of disease and no disease was identified in the lab, but by the end of the second year, all of the 15 cultivars tested were infected to some extent.
- ▶ **Over the course** of two years, the grasses with the lowest disease scores were: Fult's alkaligrass, Dawson creeping red fescue, SRX 555 SLQ slender creeping red fescue, SR 5210 slender creeping red fescue and Providence creeping bentgrass.
- ▶ **The cultivars that** had the highest disease scores in the field at the end of the study were: SR 3100 hard fescue, TransEze intermediate ryegrass, SR 4400 perennial ryegrass, SR 7200 velvet bentgrass, SR 7100 colonial bentgrass, Sabre II and Laser *Poa trivialis*, and red top.

- In the first year, Dawson creeping red fescue, SRX 555 SLQ slender creeping red fescue and SR 5210 slender creeping red fescue exhibited no *L. terrestris* was seen from these hosts in the lab.
- In the second year (2003-2004), only SRX 555 SLQ slender creeping red fescue had one of four replicate plots infested with *L. terrestris*.
- In the second year, all turf plots showed some symptom of the disease. This was confirmed by lab identification.
- Tiller infection rates varied from 2% to 80% as determined in the lab.
- The degree of expression of field symptoms was generally closely related to the number of infested tillers identified in the lab.
- Agreement between the occurrence of disease expression in the field and lab identification occurred in 51 of 59 plot cases, which is significantly greater than the number that could have occurred by chance alone.
- Over the course of the two-year test, grasses that had low disease scores included Fult's alkaligrass, Dawson creeping red fescue, SRX 555 SLQ slender creeping red fescue, SR 5210 slender creeping red fescue and Providence creeping bentgrass.
- Over the course of the two-year test, entries that produced high scores for field disease were: SR 3100 hard fescue,

TransEze intermediate ryegrass, SR 4400 perennial ryegrass, SR 7200 velvet bentgrass, SR 7100 colonial bentgrass, Sabre II and Laser *Poa trivialis*, and red top.

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