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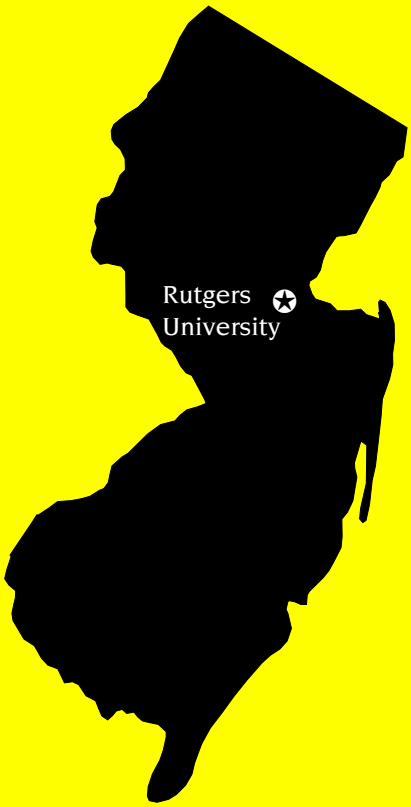

THE NEW JERSEY TURFGRASS ASSOCIATION

In Cooperation With

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The Rutgers Turfgrass Proceedings is published yearly by the Rutgers Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station, Cook College, Rutgers University in cooperation with the New Jersey Turfgrass Association. The purpose of this document is to provide a forum for the dissemination of information and the exchange of ideas and knowledge. The proceedings provide turfgrass managers, research scientists, extension specialists, and industry personnel with opportunities to communicate with co-workers. Through this forum, these professionals also reach a more general audience, which includes the public. Articles appearing in these proceedings are divided into two sections.

The first section includes lecture notes of papers presented at the 1998 New Jersey Turfgrass Expo. Publication of the New Jersey Turfgrass Expo Notes provides a readily available source of information covering a wide range of topics. The Expo Notes include technical and popular presentations of importance to the turfgrass industry.

The second section includes research papers containing original research findings and reviews covering selected subjects in turfgrass science. The primary objective of this section is to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

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Dr. Ann B. Gould, Editor
Dr. Bruce B. Clarke, Coordinator

INCIDENCE OF ENDOPHYTIC FUNGI IN SEED OF CULTIVARS AND SELECTIONS IN THE 1998 NATIONAL FINE FESCUE TEST

Michelle DaCosta, Bhavik Bhandari, Jennifer Carson, Jennifer Johnson-Cicalese, and William Meyer[1]

The fine fescues (*Festuca* spp.) are fine leafed, cool season turfgrasses that are tolerant of shade, drought, and low pH (5.5 to 6.5) (Ruemmele et al., 1995). Their natural low maintenance requirements and ability to produce an attractive turf makes them an important turfgrass for the northeastern United States. The discovery that several species of fine fescue exhibit improved performance due to the presence of endophyte has further increased their potential value. This endophyte/plant symbiosis has been shown to enhance insect, disease, and drought resistance not only in fine fescue, but in perennial ryegrass (*Lolium perenne* L.) and tall fescue (*Festuca arundinacea* Schreb.) as well (Funk and White, 1997). Thus, the potential biological and economic impacts of endophyte-enhanced fine fescue may be of great value to turfgrass managers and researchers.

Although there is still much to learn about the nature of this beneficial association, it is now known that endophyte-produced alkaloids play a role in enhanced resistance to turfgrass pests (Richardson et al., 1997). Endophytic grasses exhibit resistance to above-ground feeding insects like chinch bugs (*Blissus* spp.), billbugs (*Sphenophorus* spp.), the fall armyworm (*Spodoptera frugiperda* Smith), and sod webworm complex (*Crambus* spp. and *Parapediasia* spp.) (Sun and Smith, 1993; Ruemmele et al., 1995). In addition, several endophyte-infected fine fescue species have shown increased resistance to dollar spot (Clarke et al., 1999), caused by *Sclerotinia homoeocarpa*. Recent turf trials at Rutgers University have demonstrated that endophyte-infected cultivars and selections of fine fescue also have increased tolerance to summer stress, producing a brighter, lusher, and denser turf (Funk and White, 1997). Endophytes, therefore, have the potential to reduce pesticide use while maintaining healthy turf.

Endophytes associated with fine fescues differ from other turfgrass endophytes. These endophytes are capable of sexual reproduction and thus are classified as *Epichloe festucae*. They are able to produce a pathogenic stage in the host referred to as “choke” in which the sexual reproductive structures, or stromata, completely or partially suppress the emergence of seed-producing panicles (Sun et al., 1990). Choke expression can reduce seed yield and quality depending on both the host susceptibility and endophyte virulence (Sun and Smith, 1993). This disease seems to be more common in cultivars of Chewings fescues, while it is absent or low in frequency in the hard and blue fescues (Funk and White, 1997). Currently, studies are being conducted that select for host plant resistance as well as new strains of endophytes that will reduce choke expression in the fine fescues.

Although the taxonomy of the fine fescues often proves difficult, most species used for turf can be divided into two groups: *F. rubra* and *F. ovina* (Huff and Palazzo, 1998). The three species within *F. rubra* include Chewings fescue (*F. rubra* ssp. *fallax*), strong creeping red fescue (*F. rubra* L. spp. *rubra*), and slender creeping red fescue (*F. rubra* var. *littoralis* Vasey). Chewings fescue is a low growing, dense turf that lacks rhizomes and tends to be more disease resistant than the other species within the *F. rubra* aggregate. Strong creeping red fescues have many long, spreading rhizomes as well as larger

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seeds. They are often mixed with Kentucky bluegrass (*Poa pratensis* L.) and turf-type perennial ryegrasses. Slender creeping red fescues have shorter, slender rhizomes and can form compact, dense turf. Species within the *F. ovina* aggregate are more difficult to distinguish. They include hard fescue (*F. brevipila* Tracey), sheeps fescue (*F. ovina* L. spp. *hirtula* (Hackel ex Travis) Wilkinson), and what some breeders refer to as blue fescue (*F. glauca* Lam). Sheeps and blue fescue exhibit a bluish-green color and persist in areas that receive little maintenance. Hard fescues are similar to sheeps fescue but usually have less of a bluish color. In addition, hard fescues have lower fertility requirements and better resistance to red thread, dollar spot, and net blotch (Meyer and Funk, 1989).

This study was conducted to determine the endophyte content in cultivars and selections entered in the 1998 National Fine Fescue Test. The National Turfgrass Evaluation Program (NTEP) has distributed seed for this national test to many locations around the country. Determining the percent enophyte infection of these seed lots, therefore, will be useful for both researchers and turfgrass managers.

PROCEDURE

Seeds from 79 entries in the 1998 National Fine Fescue Test were stained using the rose bengal staining method (Saha et al., 1988). Seeds from each entry were first soaked in an alkaline solution (5.0% aqueous ethyl alcohol, 0.5% rose bengal, and 2.5% sodium hydroxide) for 18 hours, then rinsed thoroughly in running water, and finally soaked again in a 0.25% aqueous solution of rose bengal for 4 to 6 hours. Samples were then refrigerated until time of evaluation.

The lemma and palea was removed from each individual seed. Seeds were then pressed flat and examined at 200x under a microscope. Two individuals examined at least 25 seeds apiece for a total number of 50 to 75 seeds for each entry. However, if an entry consistently showed the absence of endophyte, then only 25 seeds were examined.

RESULTS AND DISCUSSION

To compare different species of fine fescue as well as different entries within each species, data was grouped by species and then ranked in decreasing order of percent endophyte infection. Of the 79 cultivars and selections evaluated, 61 (77%) had seeds infected with endophyte (Table 1). Hard fescues exhibited the highest number of infected entries, with 22 of 24 (92%) identified with endophyte, whereas 20 of the 24 (83%) Chewings fescues and 15 of 22 (68%) strong creeping red fescues were infected. Only 1 of the 4 slender creeping red fescue entries was found to contain endophyte. In comparison to the 1993 National Fine Fescue Test, there is an increase in infected cultivars overall (77% versus 56%) and for each of the species (Sun and Smith, 1993). For example, in the 1993 National Test, 64% of the hard fescues were infected with endophyte, whereas in the 1998 National Test, 92% of the entries were infected.

The level of endophyte infection, or percent infected seeds, is also of importance. Thirteen of 79 entries had high levels of endophyte infection (greater than 75% infected seeds), 31 were moderately infected (25% to 75%), 17 had low levels of infection (less than 25%), and 18 entries had no infected seeds. Comparing this data to the 1993 National Test, there were fewer highly infected entries in the 1998 National Test, but more moderately infected entries. To obtain the benefits of endophytes, it is probably necessary for at least 25% of the seeds in a lot to be infected.

Unfortunately, endophyte viability in fine fescues has been a challenge to the seed industry (Funk and White, 1997). Viability can easily decline depending on storage and packing conditions. Seed analysis by itself cannot determine whether the endophyte will be viable in the germinating seedling and subsequent mature

plant, so further examination of actual plant tissue is needed to determine the actual level of viable endophyte.

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LITERATURE CITED

Clarke, B. B., White, J. F., Jr., Sun, S., Huff, D. R., and Hurley, R. H. 1999. Enhanced resistance to dollar spot in endophyte-infected fine fescues. Plant Disease: *in press*.

Funk, C. R., and White, J. F., Jr. 1997. Use of natural and transformed endophytes for turf improvement. Pages 229-239 *in: Neotyphodium*/Grass Interactions. C. W. Bacon and N. S. Hill, eds. Plenum Press, NY.

Huff, D. R., and Palazzo, A. J. 1998. Fine fescue species determination by laser flow cytometry. Crop Sci. 38:445-450.

Meyer, W. A., and Funk, C. R. 1989. Progress and benefits to humanity from breeding cool-season grasses for turf. Pages 31-48 *in:* Contributions from Breeding Forage and Turf Grasses, D. A. Sleper et al., eds. CSSA Spec. Publ. 15, CSSA, Madison, WI.

Richardson, M. D., Freeman, G. W., Meyer, W. A., Reddy, P. V., and White, J. F., Jr. 1997. Endophytes from fine fescues of Europe and North America. Int. Turfgrass Soc. Res. J. 8:913-918.

Ruemmele, B. A., Brilman, L. A., and Huff, D. R. 1995. Fine fescue germplasm diversity and vulnerability. Crop Sci. 35:313-316.

Saha, D. C., Jackson, M. A., and Johnson-Cicalese, J. M.. 1988. A rapid staining method for detection of endophytic fungi in turf and forage grasses. Phytopathology 78:237-239.

Sun, S., Clarke, B. B., and Funk, C. R. 1990. Effects of fertilizer and fungicide applications on choke expression and endophyte transmission in Chewings fescue. Pages 62-66 *in:* Proc. Int. Symp. on Acremonium/Grass Interactions. S. S. Quisenberry and R. E. Joost, eds. Louisiana Agr. Exp. Sta., Baton Rouge, LA.

Sun, S., and Smith, D. A. 1993. Incidence of endophytic fungi in cultivars and selections of the National Fine Leaf Fescue Test. Rutgers Turfgrass Proc. 25:167-172.

Table 1. Percent endophyte infection in seed of fine fescue cultivars and selections entered in the 1998 National Fine Fescue Test. (NOTE: Since the endophyte in these seeds are not necessarily viable, the infection rate in the resulting turf plots may be lower.)

NTEP No.	Cultivar or Selection	Endophyte infection[1] (%)
	CHEWINGS FESCUES	
36	Pick FRC A-93	94
40	Treazure	86
41	PST-4HM	86
2	ACF 092	72
12	Intrique	72
43	Shadow II	69
44	Tiffany	68
56	Jamestown II	64
26	Magic	63
57	ABT-CHW-1	62
50	Longfellow II	60
27	Pick FRC 4-92	52
18	Brittany	46
15	Ambassador	44
70	ABT-CHW-3	36
58	ABT-CHW-2	25
63	SR 5100	24
76	Banner III	6
1	ACF 083	4
32	Bridgeport	4
28	BAR CHF 8 FUS2	0
46	MB-63	0
60	Culombra	0
67	Sandpiper	0
	STRONG CREEPING RED FESCUES	
49	ISI FRR7 (4401)	87
48	ISI FRR5	84
3	ASC 082	84
22	JASPER II	72
61	SRX 52961	61

(Continued)

Table 1 (continued).

NTEP No.	Cultivar or Selection	Endophyte infection[1] (%)
	STRONG CREEPING RED FESCUES (continued)	
35	PST-EFL	52
17	Path Finder	42
20	Shade Mark	42
75	ABT-CR-3	40
34	PST-47TCR	28
14	DGSC 94	20
71	ABT-CR-2	15
37	Florentine	13
62	SRX 52LAV	8
33	PST-4FR	6
4	ASC 172	0
5	ASC 087	0
24	Salsa	0
29	BAR CF8 FUS1	0
38	Shademaster II	0
78	Common Creeper	0
79	Boreal	0
	SLENDER CREEPING RED FESCUES	
9	Dawson E+	78
8	ASR 049	0
31	BAR SCF 8 FUS3	0
59	Seabreeze	0
	HARD FESCUES	
7	AHF 009	86
52	ISI FL 12	84
69	Heron	82
51	ISI FL 11	82
10	Attila E	76

(Continued)

Table 1 (continued).

NTEP No.	Cultivar or Selection	Endophyte infection[1] (%)
	HARD FESCUES (continued)	
47	ABT-HF1	76
25	4001	69
64	SRX 3961	52
68	Osprey	50
23	Rescue 911	48
16	Oxford	44
77	MB-82	39
6	AHF 008	34
72	ABT-HF-2	33
21	Pick FF A-97	30
45	Bighorn	22
55	ABT-HF4	20
73	ABT-HF-3	18
74	Nordic	14
39	Discovery	13
54	Reliant II	11
13	Scaldis	10
19	DeFiant	0
30	BAR HF 8 FUS	0
	OTHER	
11	Minataur (HARDx BLUE)	62
65	SR3200 (BLUE FESCUE)	61
42	PST-4MB (BLUE HARD)	10
66	SR 6000 (TUFTED HAIRGRASS)	0
53	QUATRO (SHEEPS FESCUE)	0

[1] Percent infection based on 50 to 75 seeds examined for each endophyte-infected entry and 25 seeds for each endophyte-free entry.