Interactions Among Mowing Height, Nitrogen Fertility, and Cultivar Affect the Severity of Rhizoctonia Blight of Tall Fescue

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ABSTRACT

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The effects of three mowing heights (3.8, 6.4, and 8.9 cm) and three nitrogen fertility regimes (0, 24.4, and 48.8 kg N per ha per month) were assessed on epidemics of Rhizoctonia blight in four cultivars and one cultivar blend of tall fescue in 1993 and 1994. Significant differences in disease severity were observed among mowing heights, fertility regimes, and cultivars or blend in each year. In addition, significant cultivar × mowing height interactions were detected in both years, and significant cultivar × fertility interactions occurred in 1993. The cvs. Mojave and Rebel II exhibited significantly more disease than the other cultivars or blend late in the 1993 study. Analysis of interactions revealed that disease was significantly greater on these cultivars than on others at fertility regimes of 0.0 and 24.4 kg N per ha, and at mowing heights of 3.8 and 6.4 cm. In 1994, Mojave again exhibited significantly more disease than the other cultivars or blend at the 3.8 cm mowing height near the peak of the epidemic, and Rebel II was the only cultivar that displayed significantly more disease at the 6.4 cm height than at the other heights tested. Across cultivars, severity of Rhizoctonia blight was significantly greater at the 8.9 cm mowing height than at the 3.8 cm height during epidemic peaks in 1993. The opposite was observed in 1994. Each cultivar or blend exhibited significantly more disease in fertilized than in nonfertilized plots by at least one of the dates on which significant cultivar × fertility interactions were detected in 1993. In 1994, data from nonfertilized plots was withheld from analysis due to an epidemic of white blight that interfered with assessment of Rhizoctonia blight. However, significantly higher levels of disease were observed in plots treated with 48.8 kg N per ha per month than in those treated with 24.4 Kg N.

Tall fescue (*Festuca arundinacea* Schreb.) is a popular lawn grass in the southeastern United States because of its shade tolerance, ease of establishment, and lack of winter dormancy. However, susceptibility to *Rhizoctonia solani* Kühn, the cause of Rhizoctonia blight or brown patch, continues to limit the quality of this turfgrass in many private and commercial lawns. In the piedmont region of Georgia, the initial symptoms of Rhizoctonia blight are usually observed after several consecutive nights with minimum temperatures >16°C and leaf wetness periods >10 h (7). The fungus causes a foliar blight and crown rot that result in patches of necrotic turf up to a few meters in diameter (3).

Recommended practices for control of Rhizoctonia blight in tall fescue (2) include the use of resistant cultivars, avoidance of high nitrogen fertility, mowing heights <5 cm, application of fungicides, and selection of cultural practices that limit the duration of foliar wetness (e.g., the restriction of irrigation to morning and early afternoon). With the exception of studies on cultivar resistance (1,5,9,10,12, 13) these recommendations are based on test results that are limited, and some are conflicting. For example, decreasing the mowing height of the cv. Rebel has been reported to increase (11), decrease (12), and have no apparent effect (13) on severity of Rhizoctonia blight. There is also an indication that cultivars of tall fescue do not respond equally to the effects of mowing height (11,13) or nitrogen fertility (L. L. Burpee, *unpublished*) with respect to disease severity. Therefore, this study was conducted to evaluate, and further refine, some of the recommendations for suppression of Rhizoctonia blight of tall fescue.

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MATERIALS AND METHODS

Field plots (4.6 x 4.6 m) of four tall fescue cultivars (Rebel II, Mojave, Falcon, and Kentucky 31) and one cultivar blend (Rebel Supreme) consisting of 33.3% wt/wt each of the cultivars Rebel II, Rebel Jr., and Tribute, were seeded on 16 September 1992 in a Cecil sandy loam at the Georgia Experiment Station, Griffin, Ga. Seed was applied with a drop-type fertilizer spreader at a rate of 343 kg per ha. The plots were arranged in a randomized complete block design with five replications. From mid-October 1992 until May 1993, each plot received 24.4 kg N per ha of a 13-13-13 (N-P-K) fertilizer at approximately 4-week intervals (no fertilizer was applied in December, January, or February). During this time, the turf was mowed to a height of 6.4 cm every 1 to 4 weeks, allowing for an increase in canopy height of approximately 4 cm between mowings. Overhead irrigation was applied when either the turf within the plots, or surrounding turf, exhibited signs of wilt.

Beginning 1 May, each plot was divided into three 1.5-m-wide subplots that were mowed twice a week at heights of 3.8, 6.4, and 8.9 cm with a 53-cm-wide walk-behind rotary mower. Leaf clippings were collected in a bag on the mower and discarded away from the plots. Beginning 2 June, each plot was divided, perpendicular to the mowing heights, into three additional subplots that were treated with 0, 24.4 or 48.8 kg N per ha per month. The nitrogen was applied as urea with a drop-type fertilizer spreader on 2 June, 2 July, and 6 August.

On 2 June 1993, the turf in each plot was inoculated with isolate Rh 136 of *Rhizoctonia solani* anastomosis group (AG) 1 from tall fescue in Griffin, Ga. Inoculum consisted of fungus-infested grain, prepared as described previously (4), and dispensed by hand into the turfgrass canopy at approximately 7 g grain per m^2. The turf received approximately 3 mm of irrigation daily at 2000 h for the duration of the experiment to ensure extended periods of foliar wetness for disease development.

Beginning 11 June, visual estimates of the severity of Rhizoctonia blight (percent area of each subplot with foliar necrosis) were made using the Horsfall-Barratt rating scale (6). Subsequent estimates were made on 15, 18, 22, and 25 June, 2, 10, 16, and 27 July, and 5, 14, and 20 August. Estimates of disease severity for each rating date were analyzed statistically using analysis of variance with cultivar/blend, mowing height, and nitrogen fertility as factors. Analyses were performed by Statistical Analysis Software (SAS Institute Inc., Cary, N.C.) procedures. The Scott-Knott cluster analysis procedure (8) was used to separate means. Significant differences were assessed at values of P and $\alpha \leq 0.05$ unless indicated otherwise.

The study was repeated in 1994. Treatments and data analysis were the same as described for the 1993 study unless otherwise indicated. Each plot was overseeded with the appropriate cultivar or blend at 244 kg of seed per ha on 20 September 1993. The turf was fertilized, mowed, and irrigated from October 1993 until May 1994 as described for the same period in 1992 to 1993. The mowing height and nitrogen (urea) treatments commenced in the subplots on 3 May and 1 June 1994, respectively. These treatments were applied in the same directions as in 1993 (mowing: east-west; nitrogen: north-south) but they were re-randomized within the main plots. Subsequent nitrogen applications were made on 4 July and 1 August. The turf was inoculated with isolate Rh 136 of *R. solani* on 7 June. Visual estimates of disease severity were made on 10, 16, 21, 24, and 30 June, 11, 15, 22, and 28 July, and 3, 12, 24, and 30 August.

RESULTS

1993. Two epidemics of Rhizoctonia blight occurred during the study (Fig. 1). The first epidemic peaked during the third week of June and the second continued to increase from 10 July until 20 August. A decrease in disease severity occurred from approximately 25 June to 10 July. This resulted from the growth of symptomless foliage from surviving tillers despite conditions conducive to disease development (minimum temperatures >16°C and nightly leaf wetness from overhead irrigation).

Mowing height had a consistent, significant effect on disease severity throughout both epidemics (Table 1). Significant effects of fertility and cultivar occurred during the second epidemic only. Significant interactions between cultivar and mowing height or fertility were detected on specific dates during both epidemics (Table 1). No significant interactions were detected between mowing height and fertility, or between cultivar, mowing height, and fertility.

Among cultivars, significant differences in severity of Rhizoctonia blight were not observed until 14 August, when the cultivars Mojave and Rebel II exhibited significantly higher levels of disease than the other cultivars or blend tested (Fig. 1A). The high susceptibility of these cultivars was reflected in part by analysis of cultivar × fertility interactions, indicating that as nitrogen fertility increased, significantly greater disease was expressed in Mojave and Rebel II earlier in the second epidemic when compared with the other cultivars or blend tested (Fig. 2 A–C). Within cultivars, significantly more disease had developed in fertilized than in nonfertilized plots of each cultivar by at least one of the dates on which a significant cultivar × fertility interaction was detected (Table 2). By 20 August, each cultivar except Kentucky 31 exhibited a four- to fivefold increase in disease in plots fertilized with 48.8 kg N per ha per month compared with nonfertilized plots (Table 2).

When analyzed across cultivars, disease severity was significantly greater throughout the study in plots mowed at 8.9 cm than in those mowed at 3.8 cm (Fig. 1B). Disease severity was intermediate at the 6.4 cm height. This trend was evident on most rating dates, even when significant cultivar × mowing height interactions occurred (Table 3). However, by 20 August differential effects within cultivars were quite evident. The cultivars Kentucky 31 and Falcon exhibited significantly more disease at the high mowing height than at the low, while the opposite occurred in the cultivar blend Rebel Supreme, and no significant difference was detected in Mojave (Table 3). Among cultivars, the effects of mowing height on disease severity were most pronounced during the second epidemic (Fig. 3). The cultivar Rebel II and the cultivar blend Rebel Supreme exhibited significantly less disease at the 3.8 and 8.9 cm mowing heights on 16 July than did the other cultivars tested. However, by 20 August significantly higher levels of disease occurred in the cultivar Mojave at 8.9 cm, in Mojave and Rebel II at 6.4 cm, and in Mojave, Rebel II, and Rebel Supreme at 3.8 cm (Fig. 3).

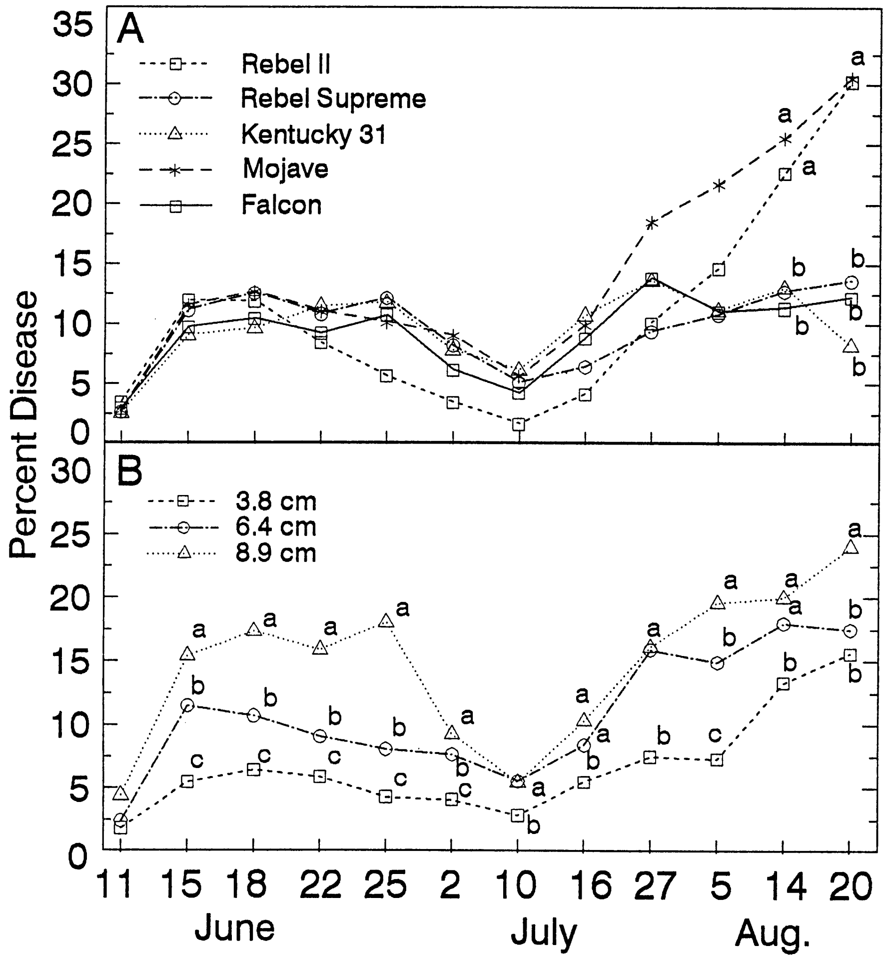

Fig. 1. Epidemics of Rhizoctonia blight of tall fescue in 1993. Effect of: **(A)** cultivar and **(B)** mowing height.

Table 1. Significance level (*P*) from analysis for variance of the effects of cultivar, mowing height and nitrogen fertility on severity of Rhizoctonia blight of tall fescue at Griffin, Ga., in 1993

	June					July				August		
Factor	**11**	**15**	**18**	**22**	**25**	**2**	**10**	**16**	**27**	**5**	**14**	**20**
Cultivar	0.64	0.47	0.21	0.73	0.73	0.39	0.47	0.49	0.24	0.09	0.03	0.00
Mowing height	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fertility	0.57	0.21	0.61	0.90	0.60	0.60	0.00	0.83	0.00	0.00	0.00	0.00
Cultivar × mowing height	0.04	0.19	0.45	0.43	0.04	0.05	0.00	0.03	0.00	0.02	0.74	0.01
Cultivar × fertility	0.38	0.06	0.01	0.06	0.58	0.17	0.93	0.68	0.00	0.01	0.03	0.00
Mowing height × fertility	0.26	0.11	0.36	0.82	0.98	0.61	0.77	0.87	0.98	0.75	0.28	0.29
Cultivar × mowing height × fertility	0.94	0.94	0.97	0.82	1.00	0.97	0.67	0.87	0.38	0.84	0.99	0.79

1994. A single epidemic of Rhizoctonia blight occurred, with a peak in severity during the third week of June and a gradual decline in disease during the remainder of the study (Fig. 4). Significant differences in disease severity were detected on several rating dates among cultivars, mowing heights, or fertility levels (Table 4) but no single factor resulted in significant effects throughout the entire study. Cultivar × mowing height interactions on 24 and 30 June were the only significant interactions that were detected among factors (Table 4).

Significant differences in disease severity among cultivars were not detected until 24 June when significantly more disease was observed in the cultivars Mojave, Rebel II, Falcon, and the cultivar blend Rebel Supreme than in Kentucky 31 (Fig. 4A). As the epidemic declined, only Mojave continued to exhibit significantly more disease than the other cultivars or blend.

Significantly more disease was observed on each rating date from 16 June through 22 July in plots that received 48.8 kg N per ha per month compared with those treated with 24.4 kg N (Fig. 4B). Data from the nonfertilized plots were not included in the analysis because the turf suffered from a severe infection of white blight (white patch) caused by *Melanotus phillipsii* (Berk. & Broome) Singer that interfered with the visual assessment of Rhizoctonia blight. Only a small amount of white patch was observed in the fertilized plots.

Analysis across cultivars revealed that turf mowed at 3.8 cm exhibited significantly more disease on 16, 21, and 24 June than turf mowed at 8.9 cm (Fig. 4C). Similarly, significantly more disease had developed in turf mowed at 6.4 cm than at 8.9 cm on 24 and 30 June. However, by 11 July growth of symptomless foliage in plots mowed at 3.8 and 6.4 cm resulted in disease severity being either significantly less (at the 3.8 cm height) or not significantly different (at the 6.4 cm height) from disease at the 8.9 cm mowing height (Fig. 4C). Analysis of cultivar × mowing height interactions on 24 and 30 June revealed that among the cultivars and cultivar blend, Mojave exhibited significantly more disease at the 3.8 cm mowing height, and Kentucky 31 had significantly less disease at the 6.3 cm height than the other cultivars or blend on each rating date (Table 5). No significant difference in disease severity was detected at the 8.9 cm mowing height on either date. Within cultivars, differences in disease severity among mowing heights were not significant on 24 and 30 June except for the cultivar Mojave, which exhibited significantly more disease at the 3.8 cm height than at the other heights on 24 June, and the cultivar Rebel II, which had significantly more disease at the 6.4 cm height on 30 June (Table 6).

DISCUSSION

Results of this study show that the severity of Rhizoctonia blight in tall fescue is significantly affected by cultivar, mowing height, and nitrogen fertility. In addition, the data confirm that cultivars do not necessarily respond equally to the effects of fertility, and particularly mowing height, on the intensity of symptom development. The cultivars or blend selected for this study were among those most commonly available on the retail market in Georgia from 1992 through 1994. The differences in susceptibility of the cultivars to *R. solani* found in this study generally reflect those in other reports (9,10,12,13). However, one prominent inconsistency exists. Results of a previous study indicated that the cultivar Rebel II is moderately resistant to *R. solani* (1) while in this study relatively high levels of disease developed in the cultivar. This discrepancy may be explained in part by interactions indicating

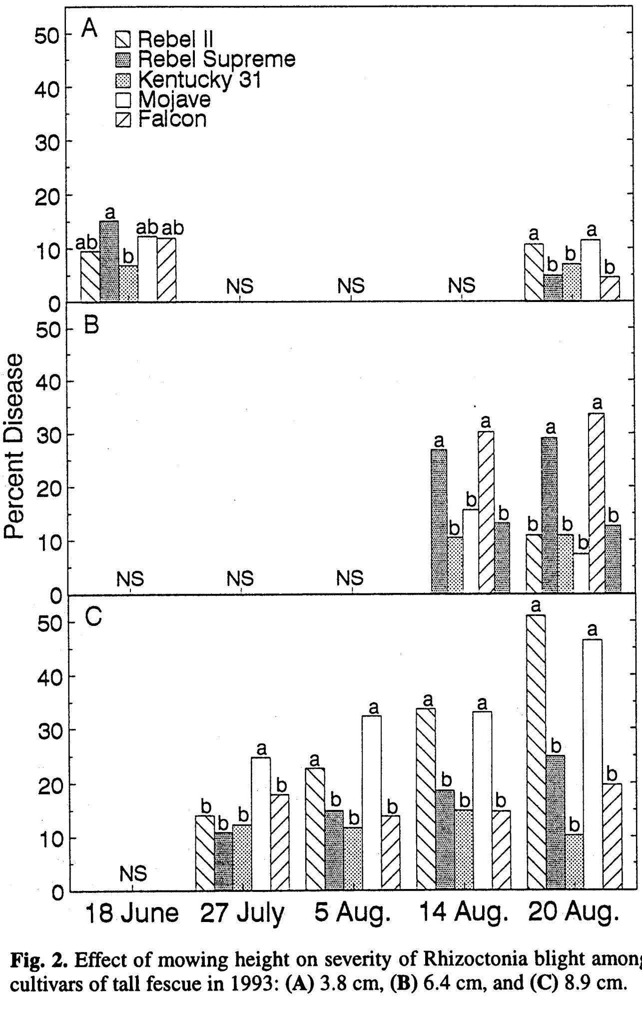

Fig. 2. Effect of mowing height on severity of Rhizoctonia blight among cultivars of tall fescue in 1993: **(A)** 3.8 cm, **(B)** 6.4 cm, and **(C)** 8.9 cm.

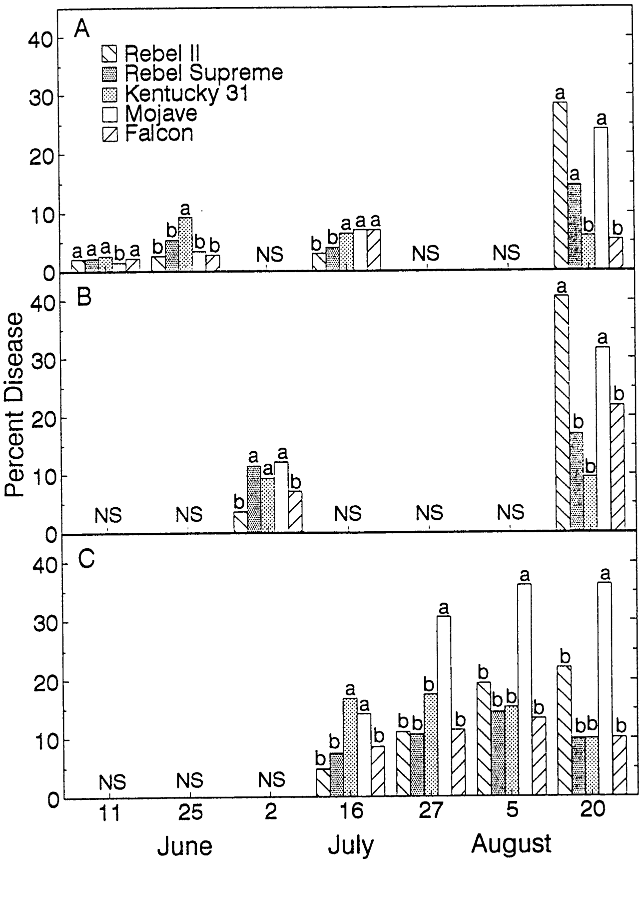

Fig. 3. Effect of nitrogen (urea) applications on severity of Rhizoctonia blight among cultivars of tall fescue in 1993: **(A)** no nitrogen, **(B)** 24.4 kg N per ha per month, and **(C)** 48.8 kg N per ha per month.

Table 2. Severity of Rhizoctonia blight within four cultivars and a cultivar blend of tall fescue maintained at three nitrogen levels from 1 June to 30 August 1993

		Percent disease				
		June[x]		August[x]		
Cultivar or blend	Kg N per ha per month[w]	18	25	5	14	20
Rebel II	0.0	9.6 a[y]	7.0 a	7.2 a	7.4 a	10.9 a
	24.4	12.3 a	9.4 a	14.2 b	26.9 b	29.0 b
	48.8	14.1 a	14.1 b	22.8 c	33.7 b	51.0 c
Rebel Supreme[z]	0.0	15.4 a	10.2 a	10.2 a	8.9 a	5.1 a
	24.4	13.7 a	7.4 a	7.6 a	10.5 a	10.9 b
	48.8	11.9 a	10.9 a	15.0 a	18.7 b	25.0 c
Kentucky 31	0.0	7.0 a	17.6 a	11.5 a	8.6 a	7.2 a
	24.4	10.9 b	11.1 a	10.3 a	15.6 a	7.4 a
	48.8	13.9 b	12.3 a	11.7 a	15.0 a	10.3 a
Mojave	0.0	12.5 a	10.2 a	10.7 a	13.5 a	11.7 a
	24.4	12.1 a	20.7 b	21.8 b	30.2 b	33.6 b
	48.8	12.1 a	24.8 b	32.4 c	33.1 b	46.3 b
Falcon	0.0	12.1 a	10.7 a	9.0 a	6.2 a	4.6 a
	24.4	9.6 a	13.1 a	10.5 a	13.1 b	12.6 b
	48.8	10.7 a	18.0 a	13.9 a	14.8 b	19.7 b

[w] Applied 2 June, 2 July, and 6 August 1993.
[x] Dates on which significant cultivar × fertility interactions were detected.
[y] Within a cultivar or blend, values in each column followed by the same letter are not significantly different at $\alpha = 0.05$ according to the Scott-Knott cluster analysis procedure.
[z] A blend of the cultivars Rebel II, Rebel Jr., and Tribute at 50%, 25%, and 25% by weight, respectively.

Table 3. Severity of Rhizoctonia blight within four cultivars and a cultivar blend of tall fescue maintained at three mowing heights from 1 May to 30 August 1993

		Percent disease							
	Mowing height	June[x]			July[x]			August[x]	
Cultivar or blend	(cm)[w]	11	25	2	10	16	27	5	20
Rebel II	3.8	2.0 a[y]	2.5 a	4.5 a	0.4 a	2.9 a	7.0 a	10.1 a	28.4 a
	6.4	2.7 a	4.9 a	3.5 a	2.5 b	4.9 a	9.4 a	14.8 a	40.5 b
	8.9	6.4 b	11.3 b	4.1 a	2.0 b	4.7 a	14.1 b	19.3 a	22.0 a
Rebel Supreme[z]	3.8	2.1 a	5.3 a	5.3 a	2.9 a	3.9 a	5.1 a	4.9 a	14.5 b
	6.4	2.5 a	15.0 b	11.3 b	7.8 b	8.2 a	10.5 a	13.7 b	16.8 b
	8.9	3.7 b	23.7 b	12.7 b	7.8 b	7.4 a	12.9 a	14.3 b	9.8 a
Kentucky 31	3.8	2.5 a	9.2 a	4.7 a	2.7 a	6.4 a	6.6 a	6.6 a	5.9 a
	6.4	2.1 a	11.1 a	9.2 b	8.8 b	9.2 a	17.0 b	11.7 b	9.4 b
	8.9	3.7 b	20.3 b	13.3 b	10.5 b	16.8 b	17.4 b	15.2 b	9.8 b
Mojave	3.8	1.4 a	3.3 a	4.7 a	5.5 a	7.0 a	6.8 a	9.0 a	24.0 a
	6.4	2.3 a	8.0 a	12.1 b	7.4 a	8.8 a	18.4 b	20.0 b	31.6 a
	8.9	4.1 b	19.5 b	12.7 b	6.1 a	14.1 b	30.5 c	35.9 c	36.1 a
Falcon	3.8	2.1 a	2.7 a	2.9 a	3.7 a	7.0 a	9.4 a	6.0 a	5.3 a
	6.4	2.7 a	5.7 a	7.0 b	5.5 a	8.4 a	21.1 b	13.3 b	10.0 a
	8.9	5.3 b	25.8 b	11.6 b	5.7 a	11.1 a	11.3 b	14.1 b	21.7 b

[w] Mowed twice per week.
[x] Dates on which significant cultivar × mowing height interactions were detected.
[y] Within a cultivar or blend, values in each column followed by the same letter are not significantly different at $\alpha = 0.05$ according to the Scott-Knott cluster analysis procedure.
[z] A blend of the cultivars Rebel II, Rebel Jr., and Tribute at 50%, 25%, and 25% by weight, respectively.

that Rebel II exhibited significant increases in disease in fertilized versus nonfertilized plots on several rating dates in 1993, and significantly higher levels of disease in plots mowed at 6.4 cm versus those mowed at 3.8 or 8.9 cm on 30 June 1994. The predisposing effects of fertility and mowing height appear to play a significant role in whether Rebel II, and other cultivars, are considered resistant or susceptible to *R. solani*, and they may explain why a cultivar such as Rebel II has not exhibited resistance in all studies (13). The cultivar Mojave, considered to be highly susceptible (1), also exhibited significant interactions with fertility and mowing height, but in general it responded as a highly susceptible cultivar relative to the others tested. A cultivar such as Mojave would appear to be an excellent candidate as a susceptible standard in evaluations of resistance in tall fescue to *Rhizoctonia*.

Applications of urea increased the severity of Rhizoctonia blight during both years of the study. This is consistent with the findings of Watkins and Wit (12) who observed more than a threefold increase in disease in plots of the cultivar Rebel treated with 73.3 kg N per ha per month from May through October compared with nonfertilized plots. The significant cultivar × fertility interactions detected in 1993 but not in 1994 suggest that differential effects of nitrogen on cultivar susceptibility are inconsistent. However, development of severe white blight disease in nonfertilized plots in 1994 may have prevented these interactions from being detected. The strong possibility that the effect of nitrogen fertility on severity of Rhizoctonia blight is cultivar dependent needs to be further investigated. The results of such a study will have a profound impact on the development of strategies for integrated disease management.

The effect of mowing height on severity of Rhizoctonia blight appears inconsistent when analyzed across culitvars. In 1993, the greatest severity occurred at the high mowing height, with the direct opposite occurring in 1994. A plausible explanation for the 1993 results is a canopy effect, whereby a longer duration of leaf wetness and possibly a more disease-conducive temperature range is produced in the deeper foliar canopy of turf mowed at 8.9 cm than in that of turf mowed at 3.8 cm.

Table 4. Significance level (*P*) from analysis for variance of the effects of cultivar, mowing height, and nitrogen fertility on severity of Rhizoctonia blight of tall fescue at Griffin, Ga., in 1994

	June					July				August			
Factor	10	16	21	24	30	11	15	22	28	3	12	24	30
Cultivar	0.39	0.31	0.92	0.00	0.33	0.00	0.02	0.00	0.00	0.00	0.02	0.32	0.25
Mowing height	0.36	0.00	0.02	0.00	0.00	0.00	0.74	0.63	0.14	0.16	0.50	0.46	0.78
Fertility	0.71	0.01	0.02	0.01	0.00	0.00	0.63	0.00	0.13	0.31	0.55	0.86	0.78
Cultivar × mowing height	0.55	0.48	0.18	0.04	0.03	0.29	0.96	0.10	0.75	0.79	0.47	0.20	0.06
Cultivar × fertility	0.71	0.43	0.98	0.92	0.99	0.82	0.97	0.66	0.92	0.83	0.95	0.92	0.94
Mowing height × fertility	0.55	0.49	0.83	0.56	0.66	0.56	0.87	0.67	0.46	0.25	0.90	0.86	0.73
Cultivar × mowing height × fertility	0.53	0.51	0.29	0.67	0.40	0.70	0.89	0.85	0.86	0.90	0.49	0.37	0.84

The lack of an apparent canopy effect in 1994 may have resulted from rain occurring on each of 28 days from 11 June through 15 July (Georgia Station weather summary). This may have negated the possible differences in duration of leaf wetness between plots mowed at the high and low heights. In 1993, rain was recorded on only 11 days over the same period.

Inconsistencies in the effects of mowing height on Rhizoctonia blight of tall fescue have been observed in other studies. Watkins and Wit (12) reported that significantly less disease developed on the cultivar Rebel mowed at 2.5 cm than at 6.4 cm, while in an earlier study Watkins et al. (11) observed an approximately a threefold increase in disease on the same cultivar at 2.5 cm compared with 6.4 cm. Yuen et al. (13) detected a significant cultivar × mowing height interaction, with several cultivars, including Rebel II, exhibiting significantly more disease than other cultivars at a mowing height of 3.8 cm but not at 7.6 cm. A similar interaction occurred in this study. Rhizoctonia blight was significantly more severe in the cultivars Rebel II and Mojave than in other cultivars at mowing heights of 3.8 and 6.4 cm at the end of the 1993 experiment. Only Mojave exhibited more disease than the other cultivars at the 8.9 cm height. In 1994, Rebel II and Mojave again displayed more disease than other culitvars at either the 3.8 cm (Mojave) or the 6.4 cm (Rebel II) height.

Declines in the epidemics of Rhizoctonia blight observed in each year of this study are difficult to explain. In both years, disease-conducive environmental conditions (7) occurred during the declines in the epidemics. Minimum ambient temperatures were consistently >16°C, and conducive durations of leaf wetness >10 h, although not directly measured, should have occurred due to nightly overhead irrigation. In addition, the amount of host tissue was not a limiting factor. The declines may have resulted from increases in populations of antagonistic microflora on leaf surfaces or possibly the survival of secondary inoculum (mycelium in foliar lesions) may have declined after periods of repeated wetting and drying of leaves.

Lawn care specialists in the piedmont region of Georgia maintain tall fescue at a minimum height of 5 cm and generally refrain from applying nitrogen from June through August to limit the severity of Rhizoctonia blight (L. L. Burpee, *unpublished*). The lack of nitrogen during this period often results in a turf stand that has poor color and density. The results of this study confirm observations of increased disease after fertilization, but cultivar × fertility interactions in 1993 suggest that at least one cultivar (Kentucky 31) can receive moderate amounts of nitrogen without exhibiting large increases in disease. In

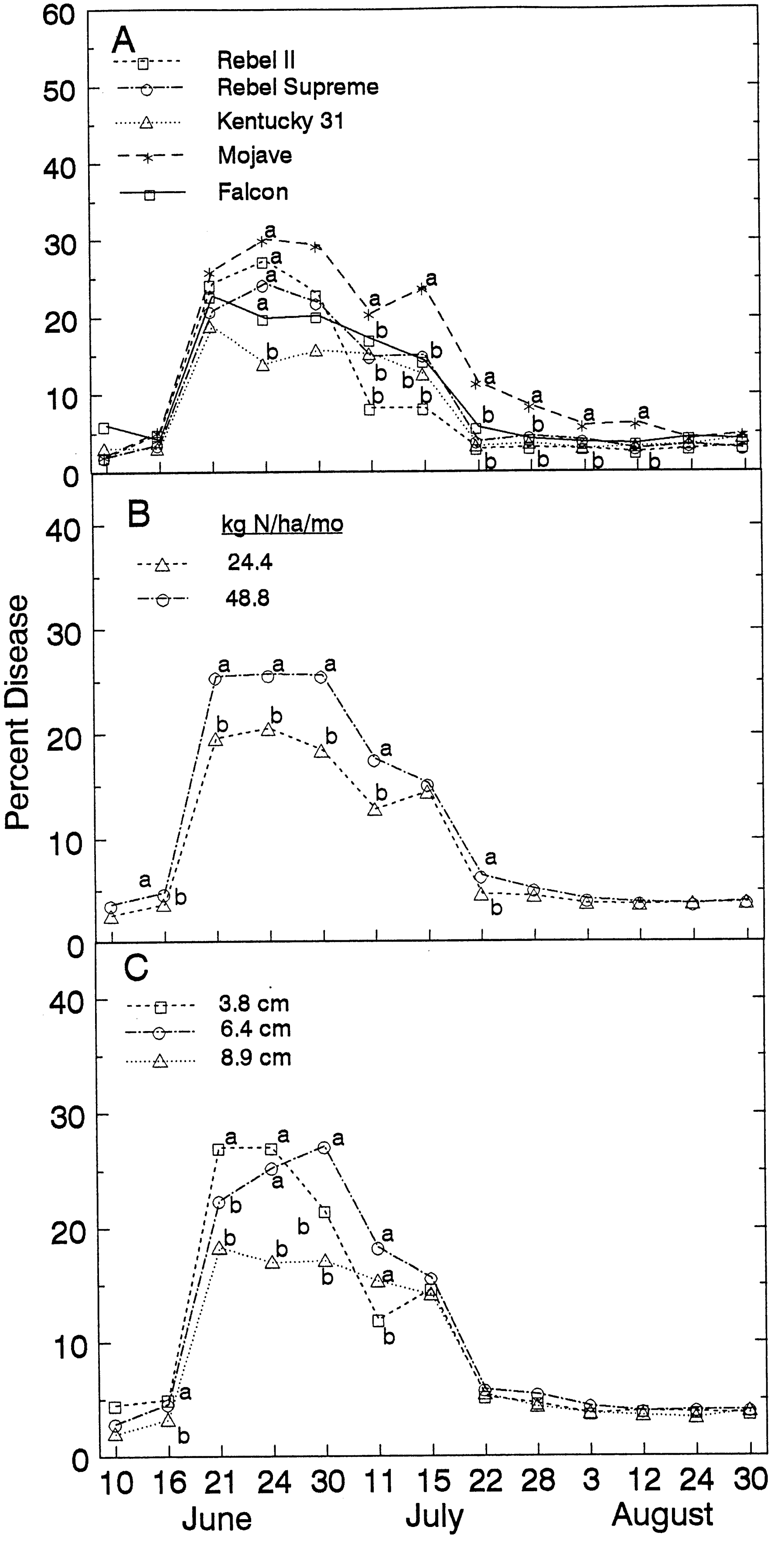

Fig. 4. Epidemic of Rhizoctonia blight of tall fescue in 1994. Effect of: **(A)** cultivar, **(B)** nitrogen application, and **(C)** mowing height.

Table 5. Severity of Rhizoctonia blight among four cultivars and a cultivar blend of tall fescue maintained at three mowing heights from 1 May to 30 August 1994[w]

	Percent disease					
	24 June[x]			30 June[x]		
Cultivar or blend	**3.8 cm**	**6.4 cm**	**8.9 cm**	**3.8 cm**	**6.4 cm**	**8.9 cm**
Rebel II	24.2 b[y]	32.4 a	25.2 a	14.1 b	36.7 a	18.2 a
Rebel Supreme[z]	29.1 b	30.5 a	13.5 a	22.5 b	28.1 a	15.2 a
Kentucky 31	13.5 b	11.7 b	16.4 a	21.3 b	11.7 b	14.1 a
Mojave	45.3 a	28.1 a	17.0 a	33.6 a	30.1 a	24.2 a
Falcon	22.9 b	23.6 a	13.2 a	17.6 b	29.1 a	14.1 a

[w] Turf was mowed twice per week.
[x] Dates on which significant cultivar × mowing height interactions were detected.
[y] Within a column, values followed by the same letter are not significantly different at $\alpha = 0.05$ according to the Scott-Knott cluster analysis procedure.
[z] A blend of the cultivar Rebel II, Rebel Jr., and Tribute at 50%, 25%, and 25% by weight, respectively.

Table 6. Severity of Rhizoctonia blight within four cultivars and a cultivar blend of tall fescue maintained at three mowing heights from 1 May to 30 August 1994[w]

Cultivar or blend	Mowing height (cm)	Percent disease 24 June[x]	Percent disease 30 June[x]
Rebel II	3.8	24.2 a[y]	14.1 b
	6.4	32.4 a	36.7 a
	8.9	25.2 a	18.2 b
Rebel Supreme[z]	3.8	29.1 a	22.5 a
	6.4	30.5 a	28.1 a
	8.9	13.5 a	15.2 a
Kentucky 31	3.8	13.5 a	21.3 a
	6.4	11.7 a	11.7 a
	8.9	16.4 a	14.1 a
Mojave	3.8	45.3 a	33.6 a
	6.4	28.1 b	30.1 a
	8.9	17.0 b	24.2 a
Falcon	3.8	22.9 a	17.6 a
	6.4	23.6 a	29.1 a
	8.9	13.2 a	14.1 a

[w] Turf was mowed twice per week.
[x] Dates on which significant cultivar × mowing height interactions were detected.
[y] Within a cultivar or blend, values in each column followed by the same letter are not significantly different at $\alpha = 0.05$ according to the Scott-Knott cluster analysis procedure.
[z] A blend of the cultivar Rebel II, Rebel Jr., and Tribute at 50%, 25%, and 25% by weight, respectively.

fact, fertilization of this cultivar may be essential to avoid severe white patch.

Use of the 5-cm mowing height may not be advisable for all cultivars of tall fescue grown in Georgia. Results of this and other studies (13) indicate that turf managers who maintain the cultivar Rebel II will observe more severe Rhizoctonia blight at the 5-cm height than at heights closer to 9 cm.

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