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Performance of Cool-Season Perennial Grasses on Poorly Drained Clay Soils

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Summary

Fifteen released and experimental varieties of tall fescue (*Festuca arundinacea* Schreb.) and a single variety of perennial ryegrass (*Lolium perenne* L.) and orchardgrass (*Dactylis glomerata* L.) were evaluated for yield, rust resistance, and persistence on the clay soils in southeast Texas. Plots were harvested for 2 years after the establishment year. All stands deteriorated with time, resulting in a complete stand loss of perennial ryegrass, orchardgrass, and three entries of tall fescue. Lack of adaptation to poorly drained clay soils was a larger factor than rust infection for growth and persistence of cool-season perennial grasses in southeast Texas.

Introduction

Cool-season perennial grasses are a desirable component of pasture systems because they grow from mid-autumn until late spring. This is a period when warm-season perennial grasses such as bermudagrass (*Cynodon dactylon* (L) Pers.) and bahiagrass (*Paspalium notatum* Flugge) produce little growth or are dormant. Small-grain - ryegrass mixtures have a similar growing season but have the added expense of annual planting. Tall fescue is the only cool-season perennial species that has been grown successfully in the lower South. Performance and adaptability decrease toward the Gulf of Mexico. New tall fescue lines have been developed from breeding programs at the University of Georgia and at Texas A&M University. A test was established at the Angleton Research Station to evaluate new tall fescue germplasm for adaptability to the Gulf Coast.

Procedure

The study was seeded at 25 lb/acre in a prepared seedbed on a Lake Charles clay in late 1986. Planting was delayed until December because of excess moisture in autumn. Plots were 4 by 15 ft in a complete randomized block with four replications. Entries consisted of 15 tall fescue cultivars and breeding lines, 'Caliente' ryegrass, and 'Palestine' orchardgrass. In spring 1987, plots were mowed several times for weed control. Fertilization during the study is reported in Table 1. On 9 Dec. 1987, plots were sprayed with 1 qt/acre of Weedmaster for weed control. Plots were harvested at a 1.5-in. height with a flail mower on 11 Mar. and 23 May 1988 and on 27 Mar. and 16 May 1989. A subsample was taken from the harvested forage from each plot to determine dry matter percentage. The same dried sample was used to determine protein content on the 1988 harvests by the Kjeldahl procedure. Visual rust ratings (percentage of leaf area infected) were made in each May before the last harvest.

Keywords: tall fescue / perennial ryegrass / orchardgrass.

Results and Discussion

The amount of rainfall during the study period is reported in Table 2. Autumn 1988 and spring 1989 were very dry, which limited forage production the second year. First-harvest yields in 1988 ranged from 2,516 to 3,810 lb/acre; 'Georgia Jessup', 'Kenhy', and 'New Georgia 5' tall fescue and Caliente ryegrass produced the most forage (Table 3). Yields decreased in all entries by the May harvest; Caliente ryegrass and Palestine orchardgrass produced the least forage. Total production ranged from 4,458 to 6,134 lb/acre; Kenhy, Georgia Jessup, and New Georgia 5 were the most productive. Kenhy, Georgia Jessup, and 'Kentucky 31' were the most susceptible to rust, while PI 26, 'Triumph', and PI 144 tall fescue and Palestine orchardgrass were rust free.

Table 1. Fertilizer applications to temperate perennial grasses at Angleton, Texas, 1987, 1988, and 1989.

Date	N	P_2O_5	K_2O
	lb/acre		
21 Apr. 1987	32	40	0
19 Oct. 1987	52	52	52
25 Jan. 1988	50	0	0
13 Sept. 1988	30	60	30
15 Dec. 1988	50	0	0
4 Apr. 1989	50	0	0

The crude protein content in March ranged from 16.78 to 20.75% (Table 4). 'Angleton' and PI 144 tall fescues contained significantly higher protein levels than those of Kenhy, Georgia Jessup, Triumph, and 'Old Georgia 5' tall fescue. In May, the protein percentage ranged from 7.70% in Triumph tall fescue to 9.61% in Caliente ryegrass.

Table 2. Monthly rainfall during the study period and long-term average.

Month	1986	1987	1988	1989	76-year mean
			in.		
Jan.		4.41	2.30	8.35	3.60
Feb.		5.33	1.75	0.63	3.19
Mar.		0.61	4.86	2.49	3.01
Apr.		0.09	7.08	2.06	3.08
May		6.78	0.98	1.36	4.22
June		4.33	2.06		4.66
July		8.33	11.74		5.11
Aug.		1.64	3.43		4.59
Sept.	5.88	5.17	9.38		5.63
Oct.	13.71	0.86	0.97		3.90
Nov.	7.39	4.82	0.59		3.83
Dec.	6.51	1.96	2.31		4.20

All entries were less productive in 1989 (Table 5). Caliente ryegrass died during the summer of 1988, and Palestine orchardgrass, and PI 25, PI 144, and Kenhy tall fescue failed to regrow after the first harvest in the spring of 1989. Total yield of remaining entries did not differ significantly. Rust was present on all surviving entries but did not appear to have a major influence on yield. Tall fescue PI 25 and 144 had very little rust in 1988 but died in 1989.

The poorly drained clay soils at the Angleton Station appeared to be an excellent site to estimate summer persistence of cool-season perennial grasses. The clay soils become dry and cracked during periods of no or low rainfall during the summer and autumn. Tall fescue germplasm survived better than the perennial ryegrass and orchardgrass cultivars. However, three tall fescue entries also failed to survive after the second year. Lack of significant difference in total yield of the remaining entries indicates that soil adaptability is more critical than is rust resistance for tall fescue persistence in the Upper Gulf Coast Prairie of Texas.

Table 3. First-year production and rust ratings of temperate perennial grasses at Angleton, Texas, 1988.

Cultivar	11 March	23 May	Total	Rust rating† 19 May
		lb DM/acre		
Kenhy tall fescue	3362 ab*	2772 a	6134 a	80.0
Georgia Jessup tall fescue	3810 a	2247 b-f	6057 ab	73.0
New Georgia 5 tall fescue	3339 a-c	2710 ab	6049 ab	25.0
Old Georgia 5 tall fescue	3232 b-c	2607 a-d	5838 a-c	23.0
Dovey tall fescue	3180 b-c	2629 a-c	5809 a-d	10.0
P.I. 26 tall fescue	2978 b-e	2723 ab	5701 a-d	3.0
Angleton tall fescue	2986 b-e	2614 a-c	5600 a-e	33.0
Kentucky 31 tall fescue	2999 b-e	2526 a-d	5524 a-e	80.0
ISI-TTFL tall fescue	2970 b-e	2336 a-e	5306 a-f	10.0
Triumph tall fescue	2836 b-e	2436 a-e	5272 a-f	0.0
P.I. 100 tall fescue	2829 b-e	2421 a-e	5250 a-f	10.0
Caliente perennial ryegrass	3356 ab	1778 f	5134 b-f	53.0
Stephenville tall fescue	2689 de	2272 a-f	4961 c-f	48.0
Temple 3 tall fescue	2798 c-e	2106 d-f	4903 d-f	33.0
Palestine orchardgrass	2989 b-e	1780 f	4769 ef	0.0
P.I. 25 tall fescue	2555 e	2163 c-f	4718 ef	15.0
P.I. 144 tall fescue	2516 e	1942 ef	4458 f	0.0

* Values within a column followed by the same letter are not significantly different at 0.05 level, Waller-Duncan multiple range test.
† Percentage of leaf area infected with rust.

Table 4. Crude protein analysis of temperate perennial grasses at Angleton, Texas, 1988.

Cultivar	March	May
	%	
P.I. 144 tall fescue	20.75 a*	8.20 c-e
Angleton tall fescue	20.68 a	8.78 a-d
P.I. 25 tall fescue	19.75 ab	8.45 b-e
Temple 3 tall fescue	19.43 ab	8.38 b-e
Caliente perennial ryegrass	19.30 ab	9.61 a
New Georgia 5 tall fescue	19.30 ab	9.08 a-c
Stephenville tall fescue	19.10 ab	8.00 de
Kentucky 31 tall fescue	18.83 ab	9.38 ab
Dovey tall fescue	18.50 ab	8.80 a-d
ISI-TTFL tall fescue	18.35 ab	8.48 b-e
P.I. 100 tall fescue	18.18 ab	8.88 a-d
Palestine orchardgrass	17.88 ab	8.70 a-e
P.I. 26 tall fescue	17.83 ab	8.18 c-e
Kenhy tall fescue	16.98 b	7.95 de
Georgia Jessup tall fescue	16.85 b	9.23 ab
Triumph tall fescue	16.85 b	7.70 e
Old Georgia 5 tall fescue	16.78 b	8.78 a-d

*Values within a column followed by the same letter are not significantly different at 0.05 level, Waller-Duncan multiple range test.

Table 5. Second-year production and rust ratings of temperate perennial grasses at Angleton, Texas, 1989.

Cultivar	27 March	16 May	Total	Rust rating† 16 May
	lb DM/acre			
Dovey tall fescue	2087 ab*	1796 ab	3883 a	25.0 c-e
Triumph tall fescue	1918 a-c	1878 a	3796 a	45.0 ab
New Georgia 5 tall fescue	1893 a-c	1851 a	3744 a	35.0 b-d
Angleton tall fescue	1822 a-c	1875 a	3696 a	22.5 d-f
ISI-TTFL tall fescue	1878 a-c	1811 ab	3690 a	52.5 a
Old Georgia 5 tall fescue	1846 a-c	1819 ab	3666 a	27.5 c-e
P.I. 100 tall fescue	2010 ab	1553 a-d	3663 a	35.0 b-d
Temple 3 tall fescue	1753 b-c	1658 a-c	3411 a	35.0 b-d
Stephenville tall fescue	1892 a-c	1231 de	3124 a	15.0 ef
P.I. 26 tall fescue	2126 a	976 e	3103 a	7.5 f
Georgia Jessup tall fescue	1587 cd	1469 b-d	3057 a	32.5 b-d
Kentucky 31 tall fescue	1758 b-c	1292 c-e	3050 a	40.0 a-c
P.I. 25 tall fescue	1580 cd	0 f	1580 b	—
Kenhy tall fescue	1436 d	0 f	1436 b	—
P.I. 144 tall fescue	727 e	0 f	727 b	—
Palestine orchardgrass	684 e	0 f	684 b	—
Caliente perennial ryegrass	0 f	0 f	0 c	—

*Values within a column followed by the same letter are not significantly different at 0.05 level, Waller-Duncan multiple range test.
†Percentage of leaf area infected with rust.