TALL FESCUE CULTIVARS IN SOUTHEASTERN KANSAS

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Joseph L. Moyer and Lyle W. Lomas[2]

A B S T R A C T

Tall fescue *(Festucu arundinacea* Schreb.) is a vigorous cool-season grass under southeastern Kansas conditions, but much of its stress resistance may relate to an endophytic fungus. Thirteen fungus-free cultivars were tested for productivity and persistence under hay production and intensive clipping management systems. Hay also was tested for forage quality. During 7 hay production years, 'Phyter' and 'Festorina' yielded significantly (P<.05) more than 'Stef', 'Johnstone', and 'AU Triumph' under hay management. Crude protein content of spring forage was highest for Stef, 'Mo-96', Phyter, and AU Triumph and lowest for 'Forager', 'Fawn', 'Mozark', and Festorina. Digestibility of spring forage was greater for 'Johnstone', Stef, 'Kenhy', and Phyter than seven other cultivars and less for Forager, 'Martin', and Mozark than seven others. Under intensive clipping, Festorina was the only cultivar that consistently yielded in the high-producing group, and Stef generally produced less than other cultivars. Stef also had consistently lower tiller density than other cultivars, but none was consistently high in tiller density. Average fall tiller density was higher under hay management than intensive clipping, but summer tiller densities varied between management systems. Of the cultivars tested, Stef was most poorly adapted to southeastern Kansas in terms of productivity and persistence, followed by Johnstone. The most productive cultivars for hay production were Phyter, Mo-96, and Festorina; the former two also ranked high in forage quality. Medium-late to late maturing cultivars generally seemed best adapted for hay production in southeastern Kansas. Festorina and Phyter usually appeared most productive under simulated grazing.

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[1] **Contribution No. 96-120-S from the Kansas Agricultural Experiment Station.**

[2] **Prof., and Prof. and Head, Kansas State Univ., Southeast Agric. Res. Ctr., P. O. Box 316, Parsons, KS 67357.**

INTRODUCTION

Tall fescue *(Fastuca arundinacea Schreb.)* is the most widely grown forage grass in southeastern Kansas. The abundance of this cool-season perennial grass is due largely to its vigor and tolerance to the extremes encountered in the climate and soils of the region, even under heavy use. Resistance to some of the stresses tolerated by tall fescue has been attributed to its association with a fungal endophyte (Acremonium coenphialum Morgan-Jones and Gams). However, this fungus also results in forage with alkaloids that reduce animal performance in spring and summer and increase the likelihood of fescue foot in winter. Because of the negative effects of the fungus on animals and the need for true comparisons of cultivars for agronomic adaptation and performance, fungus-free cultivars should be evaluated.

Many factors are involved in determining the value of a forage variety. Agronomic traits such as productivity, longevity, and response to stresses imposed by the environment are vital. However, the utility of the forage to the animal, i.e., its quality, is also of major importance. Forage quality is assessed best by animal performance during feeding trials, but crude protein content, fiber content, and in vitro digestibility can be used as indicators. Response to grazing pressure is also important in a tall fescue cultivar.

Cultivars other than ‘Ky 31’ have become more widely available in the past couple of decades. The perennial grass variety that is seeded will have far-reaching effects, so tests for productivity and stand maintenance were conducted on 13 cultivars for 8 growing seasons under hay production. Subsamples of some hay cuttings were assayed for certain quality indicators during the study. An intensive clipping treatment was imposed to subplots in mid-study to simulate some of the defoliation stresses encountered under intensive grazing.

EXPERIMENTAL PROCEDURES

Thirteen cultivars were seeded on September 4, 1986 at 20 lb/acre at the Mound Valley Unit, Southeast Agricultural Research Center; seed was ostensibly free of Acremonium coenophialum. Tillers were collected from each plot on June 5, 1991 for cytological examination and verified fungus-free. Cultivars used, descriptions, and origins are listed in Table 1. Plots were 30 x 7.5 ft each, in four randomized complete blocks. Soil was a Parsons silt loam (Mollic Albaqualf). Dates of fertilizations are shown in Table 2, Amounts of N-P_2O_5-K_2O applied beginning in 1990 were 160-50-57 lb/a in spring with 601b N/a in fall. In 1987, 80-40-40 and 40-40-40 lb/a of N-P_2O_5-K_2O were applied in spring and fall, respectively. In spring, 1988, 120 lb N/a was applied, followed by 150-45-40 lb/a of N-P_2O_5-K_2O in late winter and 50 lb/a of N in fall, 1989.

Maturity of the cultivars was evaluated by the degree of heading at harvest in 1988 and by observing the heading date of each plot before hay harvest in 1990 to 1994. Three-ft strips 15 to 20 ft in length were harvested for hay yield determination, and forage from the entire plot area was removed. The first hay cutting was in May, when all plots were headed. By that time, earlier cultivars were in the late bloom stage of development. Cuttings for hay also were taken in late summer, if sufficient forage was available, and near winter dormancy after a hard freeze. In 1990, plots were split such that a 15-ft length was used for hay harvest and the remainder was intensively clipped. When more than about 0.5 ton/acre of forage was available, the area was clipped to about 2 inches in height with a rotary mower or removed to that height with a 5-ft flail harvester with the remainder of the plot area at each hay harvest. Harvest dates for hay cuttings and number of clippings for intensively harvested subplots are listed in Table 2. Measurements of standing forage and tiller density in intensively harvested subplots were taken from a 10-ft by 7.5-ft area.

Subsamples from each hayed plot were collected for moisture determination and sometimes were analyzed also for fiber, crude protein, or in vitro digestibility after being ground to pass a l-mm screen. Forage crude protein was determined by digesting samples in H_2SO_4-H_2O_2E (Linder and Harley, 1942); assaying the digest for N (Crooke and Simpson, 1971); and multiplying the N concentration by 6.25. Neutral-detergent and acid-detergent fiber (NDF and ADF) were assayed by the method of Goering and Van Soest (1970). Forage in vitro dry matter digestibility (IVDMD) was determined using rumen inoculum from a steer fed an alfalfa hay diet for at least 2 wk prior to collection and following the procedure of Harris (1970).

RESULTS AND DISCUSSION

Maturity

Maturity differed by cultivar in each of the 6 years of evaluation (Table 3). The 5 years of heading dates resulted in a cultivar by year interaction, indicating that relative maturities of the cultivars varied by year. Three “early” cultivars, ‘AU Triumph', ‘Fawn’, and ‘Forager’, were significantly (P<.05) earlier than seven later-maturing cultivars, except in 1990, when they were earlier than five of the latest cultivars. Four “late” cultivars, ‘Mo-96, Ky 31, ‘Kenhy’, and ‘Johnstone’, headed later than six other cultivars, except in 1990, when they headed later than four of the earliest cultivars. ‘Festorina’ and “Phyter’ headed later than the three earliest cultivars in each year except 1990, so were called "medium-late". ‘Stef' headed as late as any cultivar up to 1991, but significantly earlier than two “late” cultivars from 1992 to 1994. Initially, Stef could have been called “late” but, in the last 3 years, was “medium-late” in maturity. ‘Martin’ and ‘Mozark’ headed earlier than four later and some “medium-late” cultivars, and ‘Cajun’ headed earlier than the “late” cultivars in 4 of the 6 years, so those three cultivars were called “medium-early”.

Hay Production

Forage yields of the principal hay cutting (Cut 1) for each of 8 years are listed in Table 4. Because the cultivar by year interaction was highly significant, comparisons must be made within years. Phyter was in the highest-yielding group for 6 of the 7 years when significant differences occurred and ranked second in average yield. Mo-96, the cultivar with the highest average yield, was in the “high-yield” group in the same years, except for 1989. Forager was in the top yield group for the first 3 years and in 1991 and was slightly above average for the last 3 years. Festorina was not in the “high-yield” group until 1991, but yielded well above average in each year after that. Stef was in the lowest-yielding group in each year of the test, ranking lowest each year except 1990. AU Triumph was in the “low-yield” group in 5 of the 8 test years. Johnstone and Kenhy were often low-yielding, but Johnstone in 1987 and Kenhy in 1991 were in the “high-yield” group.

Regrowth after the first cutting was sufficient for hay harvest by the end of summer in 1987, 1989, and 1992 (Table 5). Average summer hay production for the 3 years can be compared, because the cultivar by year interaction was nonsignificant. Kenhy and Stef produced higher summer yields than Forager. Those two later-maturing cultivars apparently compensated partially for low first-cut yields with increased regrowth compared to Forager, an early cultivar that yielded higher in the first cutting, Hay yields of fall regrowth for the 7 years are shown in Table 6. The cultivar by year interaction was significant, so comparisons must be made within years. Phyter was in the highest yielding group most consistently, in 5 of 7 years. Festorina was in the "high-yield" group for 3 years, as were Mozark and Cajun. However, Cajun had relatively low yields in 1988 and 1991. Kenhy had the top fall yields in 1988 and 1991, but ranked lowest in 1989. Stef was in the "low-yield" group in each year except 1991, and Johnstone in each year except 1990. Forager and Fawn were in the "low-yield" group for 3 years and the "high-yield" group for 1 year.

Total forage yield of cultivars under hay management is shown by year in Table 7. Because the cultivar by year interaction was not significant, the 7-year average cultivar yields can be compared. Stef yielded less than any other cultivar. Phyter and Festorina yielded significantly (P<.05) more than Johnstone and AU Triumph; Phyter also yielded more than Cajun. None of the three early cultivars yielded much above the average, whereas three of the four late cultivars had above-average yields.

Forage Quality

Forage crude protein contents for the cultivars under hay cutting management were determined on Cut 1 (spring) forage in 1987, 1990, 1991, and 1992; on summer forage in 1987 and 1992; and on fall forage in 1987, 1990, and 1992. Within each harvest time, the cultivar by year interactions were not significant (P>.20), so means across years are shown in Table 8. Crude protein contents were significantly (P<.05) higher in spring forage from Stef, Mo-96, and Phyter than Forager, Fawn, Mozark, and Festorina. In summer forage, crude protein contents of Stef and Ky-31 were significantly lower than for Martin, Phyter, Mo-96, and Johnstone. Fall forage protein contents were similar among cultivars.

Neutral-detergent fiber contents for the cultivars under hay cutting management were assayed on Cut 1 (spring) forage in 1987, 1990, 1991, and 1992 and on summer and fall forage in 1987 and 1992. Within each harvest time, the cultivar by year interactions were not significant (P>.05), so means across years are shown (Table 9). In spring forage, Phyter and Stef had significantly lower NDF contents than Forager and Mozark. In summer forage, Phyter, Mo-96 and Martin were significantly lower in NDF contents than Forager, Kenhy, and AU Triumph. Fall forage NDF contents were significantly lower for Phyter, Mozark, and Forager than for Stef, Johnstone, AU Triumph, and Martin.

Acid-detergent fiber contents for the cultivars under hay cutting management were determined on Cut 1 (spring) forage in 1990, 1991, and 1992 and on summer and fall forage in 1992. In spring forage, the cultivar by year interaction was not significant (P>.05), so the means across years are shown (Table 10). AU Triumph, Fawn, Phyter, and Johnstone had significantly lower ADF contents of spring forage than Ky-31. In summer forage, no significant differences occurred in ADF contents among cultivars. The ADF contents of fall forage were significantly lower for Festorina than for Stef, Ky-31, and Kenhy.

Forage IVDMD of the cultivars was assayed on Cut 1 (spring) forage in 1990, 1991, and 1992 and on fall forage in 1990. In spring forage, the cultivar by year interaction was not significant (P>.05), so the means across years are shown (Table 11). Johnstone, Stef, Kenhy, and Phyter had significantly higher forage digestibility than eight other cultivars. Conversely, Forager, Martin, and Mozark had lower IVDMD than seven other cultivars. Forage of the latter three cultivars plus that of Fawn, AU Triumph, Cajun, and Festorina was less digestible than that of the five cultivars that were above-average in IVDMD. Fall, 1990 IVDMD showed no significant differences among cultivars.

Intensive Clipping

Forage yield estimates of cultivars under the intensive clipping treatment that was imposed from 1990 to 1994 are listed in Table 12. A significant cultivar by year interaction occurred, so comparisons must be made within years. Festorina was in the highest producing group of cultivars in each of the 4 years of intensive clipping. Phyter was in the high-producing group in 1992 and 1993 but was a low forage producer in 1990. Johnstone also was classed as a “high-yield” cultivar in 1990 and 1991 but fell into the “low-yield” group in 1993. Kenhy followed the opposite trend, producing in the “high-yield” group in 1991 but being **a** low producer in 1992 and 1993. Mozark was in the “high-yield” group only in 1990 but produced near or above the test average in the other 3 years. Stef was in the “low-yield” group in 3 of the 4 years of the test. Forager and Martin were in the “low-yield” group in 1991 and 1992.

Tiller Density

Tiller density data for the cultivars under clipping or haying management showed no significant (P>.10) cultivar by management interaction at any of the times when tillers were counted. Thus, tiller densities of the cuitivars shown in Table 13 are averages for the two management systems. Stef had a relatively low tiller density (“thin” stand) each time that counts were made. Kenhy and Ky-31 had lower tiller densities than the “thick-stand” group at an intermediate and the final count. Johnstone also was relatively thin at an intermediate and the final count but had among the highest tiller densities at the first count. Mo-96 had the highest density in spring, 1992 but was among the “thin” group at the final count. Conversely, Triumph had relatively low tiller densities in 1991 but had the highest density at the final count. Martin showed a similar, though less dramatic, trend. Fawn had relatively high tiller densities at the first and an intermediate count. Other cultivars that had relatively high tiller densities included Festorina early in the study; Phyter and Forager in spring, 1993; and Mozark at the last count.

Tiller density for the two management systems showed variable responses at different times during the study (Table 14). In late fall, tiller density was consistently greater under the hay management system than under intensive clipping. However, tiller densities in the summer did not differ consistently.

Conclusions

Of the cultivars tested, Stef was most poorly adapted to southeastern Kansas in terms of productivity and persistence, followed by Johnstone. Kenhy was inconsistent in performance and did not maintain itself well. AU Triumph and Cajun were usually relatively low in forage production. The most productive cultivars for hay production were Phyter, Mo-96, and Festorina, with the former two also ranking high in forage quality. Forager was among the top producers in first-cut forage, but forage quality was often lower and yield of later cuttings was reduced, perhaps because of its early maturity. Medium-late to late maturing cultivars generally seemed better adapted than early cultivars for hay production in southeastern Kansas. Festorina and Phyter appeared to be most productive under simulated grazing.

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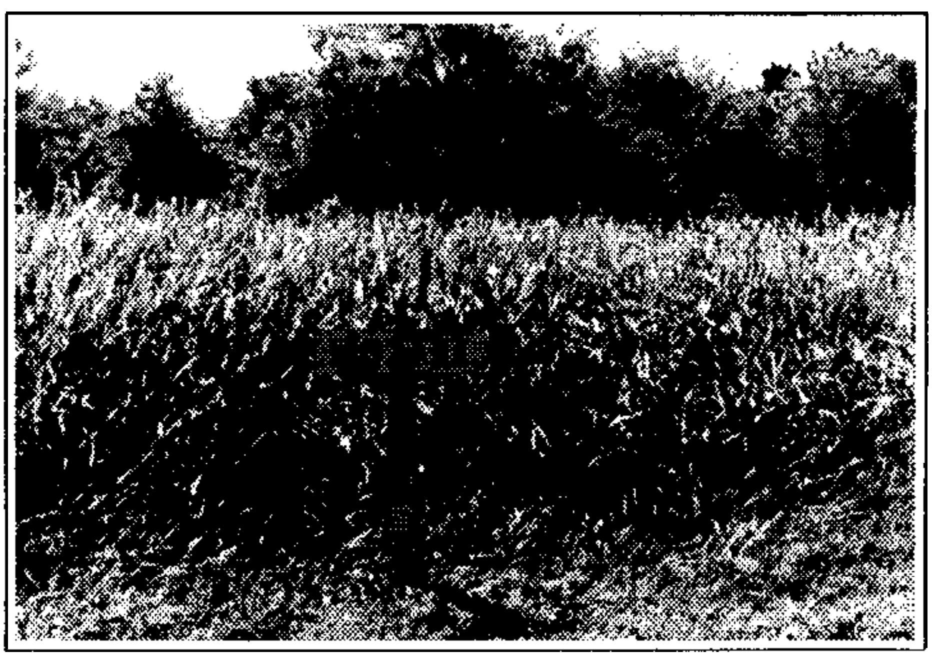

Table 1. Cultivars, Years of Release, and Origins of Tall Fescue Cultivars Seeded in 1986 at the Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Year of Release	Origin
AU Triumph	1982	Alabama Agric. Exp. Stn., Auburn Univ., Auburn, AL 36849
Cajun	1987	International Seeds, Inc., Halsey, OR, 97348
Fawn	1964	Oregon Agric. Exp. Stn., Oregon State Univ., Corvallis, OR 97331
Festorina	1985	Advanta Seed (fomerly Van der Have), Albany, OR 97321
Forager	1980	FFR cooperative, W. Lafayette, IN 47906
Johnstone	1982	USDA and Kentucky Agric. Exp. Stn., Univ. of Kentucky, Lexington, KY 40546
Kenhy	1976	USDA and Kentucky Agric. Exp. Stn., Univ. of Kentucky, Lexington, KY 40546
Ky-31	1943	Kentucky Agric. Exp. Stn., Univ. of Kentucky, Lexington, KY 40546
Martin	1987	Missouri Agric. Exp. Stn., Univ. of Missouri, Columbia, MO 65211
Mozark	1987	Missouri Agric. Exp. Stn., Univ. of Missouri, Columbia, MO 65211
Mo-96	1977	Missouri Agric. Exp. Stn., Univ. of Missouri, Columbia, MO 65211
Phyter	1988	FFR cooperative, W. Lafayette, IN 47906
Stef	1985	NorFarm Seed (formerly Northern Farm and Garden), Bemidji, MN 56601

Table 2. Dates for Fertilization, Hay Harvest, and Tiller Counts and Number of Intensive Clippings of Subplots in Each Year of the Tall Fescue Cultivar Trial, Mound Valley Unit, Southeast Agricultural Research Center

	Year							
Operation	1987	1988	1989	1990	1991	1992	1993	1994
	---Julian Date---							
Fertilization								
Spring	69	19	--	81	48	61	68	48
Fall	245	340	255	250	249	232	271	--
Hay Harvest								
cut 1	128	130	131	149	148	147	146	137
cut 2	176	308	251	323	330	224	271[1]	257[1]
cut 3	300	--	332	--	--	356	298	339[1]
Tiller Count	--	--	--					
Summer	--	--	--	--	157	178	174	195
Fall				--	344	357	--	354
	---Number---							
Clippings	--	--	--	7	6	9	6	7

[1]Yield data not collected because of weeds.

Table 3. Relative Maturity (1988) and Heading Dates of Cultivars in the Tall Fescue Cultivar Trial, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Maturity Rating (0-5)[1]	Heading Date[2] 1990	1991	1992	1993	1994	5-Yr Avg
		---Julian Date---					
Mo-96	1.8	124	122	131	131	127	127
Ky-31	1.8	122	122	129	129	130	126
Kenhy	1.5	121	124	125	129	130	126
Johnstone	1.8	123	124	126	129	127	126
Stef	1.5	128	124	121	127	123	125
Festorina	2.0	120	122	123	130	124	124
Phyter	2.2	120	120	125	127	126	124
Cajun	4.0	120	119	116	124	120	120
Mozark	3.8	117	117	116	125	121	119
Martin	3.0	118	115	116	124	117	118
Forager	4.8	116	115	112	124	117	117
Fawn	4.2	117	113	112	124	116	117
AU Triumph	4.5	117	108	111	124	116	115
Average	2.8	120	119	120	127	122	122
LSD(.05)	0.9	3.5	3.5	6.8	2.4	5.6	---[3]

[1] Degree of heading on May 9, 1988, where 0 is no heads, and 5 = 100% headed.
[2] Julian day when 50% of tillers were headed.
[3] Year x Variety interaction was highly significant (P<.01).

Table 4. Yield of Tall Fescue Cultivars at Principal Hay Cutting (Cut 1), Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Forage Yield								
	1987	**1988**	1989	1990	1991	1992	1993	1994	8-Yr Avg
	---tons per acre @ 12% moisture---								
Mo-96	3.03	3.20	2.38	4.57	4.74	4.01	4.29	4.94	3.89
Phyter	2.81	3.39	2.49	4.83	4.51	4.06	4.28	4.60	3.87
Festorina	3.02	3.03	2.34	4.24	4.66	3.98	4.19	5.22	3.83
Forager	3.13	3.49	2.53	4.15	4.50	3.68	3.97	5.17	3.83
Mozark	2.65	3.27	2.38	4.37	4.63	3.89	3.73	5.22	3.77
Ky-31	2.77	3.10	2.18	4.38	4.55	3.73	4.42	4.85	3.75
Martin	2.67	3.28	2.73	4.13	4.35	3.92	3.92	4.51	3.69
Fawn	2.76	3.58	2.38	4.06	4.27	3.82	4.12	4.50	3.69
Kenhy	3.05	2.84	1.78	4.39	4.61	3.29	3.65	4.71	3.54
Johnstone	3.12	2.50	1.96	4.21	4.41	3.29	3.95	4.81	3.53
Cajun	2.79	3.20	2.09	3.93	4.22	3.17	3.87	4.89	3.52
AU Triumph	2.61	3.32	2.03	3.68	3.96	3.32	3.51	4.80	3.40
Stef	1.93	2.21	1.65	3.94	3.79	1.85	3.03	4.38	2.85
Average	2.79	3.11	2.22	4.22	4.40	3.54	3.92	4.81	3.63
$LSD_{(.05)}$	0.49	0.56	0.62	0.73	0.54	0.63	0.53	0.50	---[1]

[1] Year x Variety interaction was highly significant (P<.01)

Table 5. Summer Yield of Tall Fescue Cultivars Harvested under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	1987	1989	1992	Average
	----------- tons/acre@12%moist. -----------			
Kenhy	2.56a[1]	3.10a	2.28ab	2.65a
Stef	2.39a	2.79ab	2.75a	2.64a
Ky-31	2.10a	3.08a	2.43ab	2.54ab
Phyter	2.23a	2.87ab	2.36ab	2.49ab
Martin	2.40a	2.83ab	2.16ab	2.46ab
Cajun	2.40a	2.66ab	2.22ab	2.43ab
Festorina	1.96a	2.84ab	2.48ab	2.42ab
AU Triumph	2.48a	2.61ab	2.11ab	2.40ab
Mo-96	2.30a	2.67ab	1.98ab	2.31ab
Mozark	2.11a	2.55ab	2.20ab	2.28ab
Johnstone	2.13a	2.68ab	2.03ab	2.28ab
Fawn	2.32a	2.32b	2.06ab	2.24ab
Forager	2.23a	2.51ab	1.79b	2.17b
Average	2.28	2.73	2.23	2.41[2]

[1] Means within a column followed by the same letter are not significantly (P<.05) different according to Duncan's test.
[2] Cultivar x Year interaction was not significant (P>.90).

Table 6. Fall Forage Yield (Cut 2 or 3) of Tall Fescue Cultivars Harvested in November under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

	Forge Yield							
Cultivar	1987	1988	1989	1990	1991	1992	1993	7-Yr Avg
	tons per acre @ 12% moisture							
Festorina	3.46	2.59	1.47	3.11	0.85	1.61	0.62	1.96
Phyter	3.47	2.74	1.40	2.99	0.82	1.74	0.51	1.95
Mozark	3.00	2.36	1.46	3.32	0.94	1.76	0.67	1.93
Kenhy	3.26	3.16	0.85	2.85	1.03	1.47	0.56	1.88
Cajun	3.52	2.08	1.47	2.95	0.80	1.54	0.76	1.87
Martin	3.37	2.36	1.41	2.88	0.83	1.52	0.64	1.86
Ky-31	3.16	2.64	0.98	2.83	0.98	1.64	0.52	1.82
AU Triumph	3.31	2.14	1.37	2.88	0.87	1.54	0.64	1.82
Mo-96	3.54	2.22	1.30	2.69	0.74	1.51	0.61	1.80
Fawn	3.00	2.17	1.36	2.92	0.79	1.54	0.70	1.78
Forager	3.47	2.25	1.13	2.85	0.78	1.34	0.55	1.77
Johnstone	2.69	2.28	1.00	2.70	0.74	1.39	0.50	1.61
Stef	2.93	2.30	0.99	2.21	0.85	1.07	0.45	1.54
Average	3.24	2.41	1.25	2.86	0.85	1.51	0.59	1.81
LSD(.05)	0.52	0.53	0.19	0.54	0.23	0.27	0.24	--[1]

[1]Cultivar x Year interaction was significant (P=.02).

Table 7. Total Forage Yield (12% Moisture) of Tall Fescue Cultivars Harvested under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

	Forage Yield							
Cultivar	1987	1988	1989	1990	1991	1992	1993	7-Yr Avg
	--tons per acre--							
Phyter	8.52	6.13	6.76	7.82	5.33	8.16	4.79	6.78
Festorina	8.44	5.62	6.64	7.35	5.50	8.06	4.82	6.63
Mo-96	8.87	5.42	6.34	7.26	5.48	7.50	4.90	6.54
Ky-31	8.04	5.74	6.24	7.20	5.53	7.80	4.03	6.50
Martin	8.44	5.64	6.96	7.00	5.18	7.60	4.55	6.48
Mozark	7.76	5.63	6.39	7.69	5.56	7.85	4.40	6.47
Kenhy	8.87	6.00	5.73	7.24	5.64	7.04	4.21	6.39
Forager	8.82	5.74	6.17	7.00	5.28	6.80	4.52	6.33
Fawn	8.08	5.74	6.05	6.97	5.06	7.42	4.82	6.31
Cajun	8.71	5.28	6.22	6.88	5.03	6.93	4.60	6.23
AU Triumph	8.40	5.45	6.00	6.56	4.83	6.97	4.15	6.05
Johnstone	7.94	4.78	5.64	6.91	5.14	6.71	4.44	5.94
Stef	7.26	4.50	5.42	6.15	4.64	5.66	3.48	5.30
Average	8.32	5.51	6.13	7.08	5.25	7.27	4.51	6.30
LSD(.05)	0.91	0.84	NS	1.04	0.61	0.93	0.53	0.50[1]

[1]Year x Variety interaction was nonsignificant (P=.56).

Table 8. Forage Crude Protein Content (N X 6.25) of Tall Fescue Cultivars Harvested at Different Times of the Year under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

	Forage Crude Protein		
Cultivar	Spring[1]	Summer	Fall
	- - - - - - - -	%	- - - - - - - -
Stef	12.3	9.8	10.1
Mo-96	11.9	11.5	10.7
Phyter	11.8	11.5	10.8
AU Triumph	11.5	10.7	10.3
Martin	11.3	12.3	10.3
Kenhy	11.3	9.6	10.1
Cajun	11.2	10.6	10.0
Johnstone	11.2	11.2	10.4
Ky-31	11.1	9.7	10.1
Festorina	10.7	10.8	10.0
Mozark	10.7	10.1	10.7
Fawn	10.6	10.6	10.2
Forager	10.5	10.0	10.5
Average	11.2	10.6	10.3
LSD(.05)	1.0[2]	1.4	NS

[1] Spring, Summer, and Fall values are means of 4 years, 2 years, and 3 years, respectively.
[2] Year x Variety interactions were not significant (P>.20).

Table 9. Forage Neutral-Detergent Fiber Content of Tall Fescue Cultivars Harvested at Different Times of the Year under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

	Neutral-Detergent Fiber		
Cultivar	Spring[1]	Summer	Fall
Phyter	61.2c[2]	64.5	61.9
Stef	61.2c	66.5	66.3
Mo-96	61.3bc	64.5	62.8
Fawn	61.7abc	67.4	63.6
Johnstone	62.2abc	65.9	65.1
Au Triumph	62.2abc	68.1	64.7
Kenhy	62.3abc	68.2	64.2
Cajun	63.0abc	66.4	63.1
Ky-31	63.0abc	67.4	64.1
Festorina	63.2abc	67.0	62.7
Martin	63.4abc	65.6	64.7
Mozark	63.9ab	66.8	62.4
Forager	64.0a	68.3	62.5
Average	62.5	66.7	63.7
LSD(.05)	NS[3]	2.3	2.2

[1]Spring, Summer, and Fall values are means of 4 years, 2 years, and 2 years, respectively.
[2]Means within a column followed by the same letter are not significantly ($P<.05$) different according to Duncan's test.
[3]Cultivar x Year interactions were not significant ($P>.05$).

Table 10. Forage Acid-Detergent Fiber Content of Tall Fescue Cultivars Harvested at Different Times of the Year under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

	Acid-Detergent Fiber		
	Spring[1]	Summer	Fall
	----------	%	----------
AU Triumph	34.1b [2]	34.4	30.1
Fawn	34.2b	33.7	30.1
Phyter	34.3b	32.8	29.8
Johnstone	34.3b	33.9	29.5
Cajun	34.5ab	33.8	30.4
Stef	34.5ab	35.8	33.8
Forager	34.6ab	33.6	29.4
Mo-96	34.8ab	33.2	29.3
Mozark	34.8ab	34.0	30.6
Festorina	34.9ab	33.1	28.7
Kenhy	35.2ab	34.8	31.0
Martin	35.2ab	33.5	30.3
Ky-31	35.7a	35.8	31.1
Average	34.7	34.0	30.3
LSD(.05)	NS[3]	NS	2.2

[1]Spring, Summer, and Fall values are means of 3 years, 1 year (1992), and 1 year, respectively.
[2]Means within a column followed by the same letter are not significantly (P<.05) different according to Duncan's test.
[3]Cultivar x Year interaction was not significant (P>.05).

Table 11. Forage in Vitro Dry Mattes Digestibility of Tall Fescue Cultivars Harvested at Different Times of the Year under Hay Cutting Management, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	In Vitro Dry Matter Digestibility	
	Spring[1]	Fall
	------------- % -------------	
Johnstone	56.0	63.2
Stef	55.7	59.6
Kenhay	55.4	61.8
Phyter	54.6	58.8
Mo-96	54.4	61.7
Ky-31	53.3	61.3
Festorina	53.2	61.8
Cajun	53.0	60.1
AU Triumph	52.6	59.3
Fawn	52.5	59.2
Mozark	52.0	58.0
Martin	51.7	61.9
Forager	51.6	60.0
Average	53.5	60.5
LSD(.05)	1.2[2]	NS

[1]Spring and Fall values are means of 3 years, and 1 year (1990), respectively.
[2]Year x Variety interactions were not significant (P>.20).

Table 12. Yield Estimate of Tall Fescue Cultivars Harvested under Intensive Clipping Treatment, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Forage Yield[1]				
	1990	1991	1992	1993	Average
	--------------tons/acre@12%moisture-----------------				
Festorina	5.21	4.25	6.23	5.40	5.27
Phyter	4.18	4.17	6.57	5.34	5.07
Mozark	5.20	4.08	5.93	5.01	5.05
Johnstone	5.14	4.28	5.69	4.85	4.99
Ky-31	4.87	3.99	5.59	5.27	4.93
AU Triumph	5.30	3.93	5.37	5.00	4.90
Mo-96	4.46	3.89	5.90	5.32	4.89
Fawn	4.85	3.69	5.41	5.42	4.84
Cajun	4.59	3.98	4.85	5.35	4.69
Kenhy	4.48	4.46	4.80	4.50	4.56
Forager	4.46	3.61	5.14	5.01	4.55
Martin	4.32	3.71	5.01	5.18	4.55
Stef	3.39	4.09	3.73	3.73	3.74
Average	4.65	4.01	5.40	5.03	4.77
LSD(.05)	0.93	0.61	0.99	0.55	- -[2]

[1] Sum of forage yield estimates from disk meter readings of standing forage prior to each clipping.
[2] Cultivar x Year interaction was highly significant (P<.01).

Table 13. Tiller Density of Tall Fescue Cultivars over Time, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Year and Number						
	1991-1[1]	1991-2	1992-1	1992-2	1993-1	1994-1	1994-2
	tillers per ft^2						
Triumph	27.8	18.8	51.2	49.4	33.4	21.2	37.2
Mozark	30.8	26.2	54.4	45.2	28.7	13.1	37.0
Martin	30.6	24.7	39.2	44.9	26.9	32.9	33.4
Forager	29.6	28.7	47.8	52.6	36.3	19.3	32.0
Phyter	33.6	26.8	57.0	54.2	37.2	18.8	31.5
Fawn	37.5	29.6	49.3	52.7	36.1	21.9	31.3
Festorina	28.9	32.1	51.2	45.7	29.5	24.5	29.5
Cajun	28.5	19.8	41.4	49.4	25.2	16.3	29.5
Mo-96	33.3	28.2	60.3	53.9	31.2	6.3	24.1
Johnstone	38.2	24.0	50.0	53.9	23.8	15.4	23.2
Ky-31	29.4	24.3	48.5	48.9	14.6	15.9	19.9
Kenhy	31.0	21.7	47.3	30.5	27.6	21.2	18.9
Stef	18.7	6.7	18.1	12.7	13.3	8.9	9.3
Average	30.1	24.0	47.2	45.7	28.0	18.1	27.4
$LSD_{(.05)}$	9.2	11.1	19.0	13.3	12.3	NS	11.2

[1] Tiller count number per year where 1 = Summer and 2 = Fall (see Table 2).

Table 14. Tiller Density at Different Times for Tall Fescue Cultivars under Hay Cutting and Intensive Clipping Management, Mound Valley Unit, Southeast Agricultural Research Center

	Cutting Management		
Time	Haying[1]	Clipping	P > F
	---tillers per ft^{-2}---		
Summer, 1991[2]	28.4	32.8	*
Fall, 1991	25.9	22.0	**
Summer, 1992	48.8	45.6	NS
Fail, 1992	47.9	39.2	***
summer, 1993	30.3	25.6	†
Summer, 1994	16.6	19.6	NS
Fall, 1994	29.2	25.6	*

[1]Under hay management, plots were cut 2-3 times per year, whereas under intensive clipping, plots were cut 6-7 times per year (see Table 2 for dates).

[2]Summer and fall dates for counting tiller density are shown in Table 2.

***,**,*,† Means within a date differed at P<.00l, .01, .05, and .10, respectively.