

2008 Cool-Season Grass Horse Grazing Tolerance Report

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Introduction

Cool-season grasses such as bluegrass, tall fescue, and orchardgrass are dominant pasture grasses for horses in Kentucky. Variety evaluations for yield have been carried out for many years, but little work has been done to establish the effect of variety on persistence when subjected to close, continuous grazing by horses.

The purpose of this report is to summarize current research on the grazing tolerance of varieties of tall fescue, orchardgrass, and other species when subjected to continuous heavy grazing pressure by horses within the grazing season. The main focus will be on stand survival.

The UK Forage Extension Web site at <www.uky.edu/Ag/Forage> contains electronic versions of all forage variety testing reports from Kentucky and surrounding states and from a large number of other forage publications.

Description of the Tests

Tests were established in Lexington in the fall of 2004, 2005, 2006 and 2007. The soils at this location are well-drained silt

loams and are well suited to tall fescue, orchardgrass, and other cool-season grasses. Plots were 5 by 15 feet in a randomized complete block design, with each variety replicated six times. Plots were seeded at the recommended seeding rate per acre and were planted into a prepared seedbed using a disk drill. Grazing was continuous from April to October.

Plots were grazed down to below 4 inches quickly and were maintained at 1 to 3 inches for the remainder of the grazing season. Supplemental hay was fed during periods of slowest growth. Visual ratings of percent stand were made in the fall several weeks after the horses were removed to check stand survival after the grazing season and in the spring prior to grazing to check on winter survival and spring growth. Since trials were seeded in rows, persistence ratings were based on density within a row and not total ground cover. Grass plots were fertilized with 60 pounds of actual N per acre in the spring and 30 to 40 pounds of actual N in early November after horses were removed from the pasture. Other fertilizers (lime, P, and K) were applied as needed.

Results and Discussion

Weather data for Lexington for 2005, 2006, 2007 and 2008 are presented in Table 1.

Data on percent stand are presented in Tables 3, 4, 5, and 6. Table 2 presents grazing preference data.

Statistical analyses were performed on all entries (including experimentals) to determine if numerical differences are truly due to variety. Varieties not significantly different from the highest numerical value in a column are marked with one asterisk (*). To determine if two varieties are truly different, compare the difference between the two varieties to the Least Significant Difference (LSD) at the bottom of the column. If the difference is equal to or greater than the LSD, the varieties are truly different when grown under the conditions at a given location. The Coefficient of Variation (CV), which is a measure of the variability of the data, is included for each column of means. Low variability is desirable, and increased variability within a study results in higher CVs and larger LSDs.

In general, commercial varieties of tall fescue and orchardgrass tolerated over-

Table 1. Temperature and rainfall at Lexington, Kentucky in 2005, 2006, 2007 and 2008.

	2005				2006				2007				2008 ²			
	Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall	
	°F	DEP ¹	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	37	+6	4.35	+1.49	42	+11	4.77	+1.91	37	+6	2.93	+0.07	33	+2	4.60	+1.74
FEB	39	+4	1.68	-1.53	36	+1	2.13	-1.08	27	-8	1.83	-1.38	36	+1	5.37	+2.16
MAR	41	-3	2.79	-1.61	44	0	3.05	-1.35	52	+8	1.97	-2.43	45	+1	6.28	+1.88
APR	56	+1	3.30	-0.58	59	+4	3.52	-0.36	53	-2	3.87	-0.01	55	0	5.72	+1.84
MAY	61	-3	1.78	-2.69	62	-2	2.99	-1.48	68	+4	1.45	-3.02	62	-2	4.88	+0.41
JUN	75	+3	1.33	-2.33	70	-2	1.82	-1.84	74	+2	1.77	-1.89	74	+2	3.30	-0.36
JUL	77	+1	3.30	-1.70	76	0	5.13	+0.13	74	-2	6.90	+1.90	76	0	2.54	-2.46
AUG	78	+3	3.34	-0.59	76	+1	3.23	-0.70	80	+5	2.56	-1.37	75	0	1.08	-2.85
SEP	72	+4	0.59	-2.21	64	-4	9.27	+6.07	72	+4	1.15	-2.05	72	+4	1.21	-1.99
OCT	58	+1	0.92	-1.65	54	-3	4.88	+2.31	63	+6	5.28	+2.71	57	0	1.35	-1.22
NOV	47	+2	1.54	-1.85	47	+2	1.78	-1.61	46	+1	2.86	-0.53	43	-2	2.28	-1.11
DEC	32	-4	2.19	-1.79	42	+6	2.45	-1.53	40	+4	5.29	+1.31				
Total			27.51	-17.04			45.02	+0.47			37.86	-6.69			38.61	-1.96

¹ DEP is departure from the long-term average.

² 2008 data is for eleven months through November.

grazing well (Tables 3, 4 and 5), but the varieties of timothy and prairie brome (prairie grass [*Bromus willdenoii*]) in these trials did not. The sensitivity of timothy and prairie brome to heavy grazing was not surprising, as these are both erect species and sensitive to heavy defoliation. Perennial ryegrasses, Kentucky bluegrasses and festuloliums vary in tolerance to grazing.

The lack of a defined "grazing-tolerant variety" for these species makes absolute interpretation difficult. For example, endophyte-infected "Kentucky 31" (KY31+) is known to be grazing tolerant. However, there are no proven grazing-tolerant varieties for the other species. Still, certain varieties were clearly more tolerant than others.

Differences in tolerance among varieties could be due to true grazing tolerance but also to preference, especially where highly palatable species such as bluegrass and ryegrass were in the same test as tall fescue. Because of potential preference between species, comparison between varieties is most accurate within a species. These data should be taken as an indication of tolerance to periods of overgrazing. For best pasture stands, forage grasses should not be abused as in this study.

Ranking Varieties by Preference

Differences in tolerance among varieties could be due to true grazing tolerance but also to preference, as horses may graze the preferred varieties more intensely than the less preferred varieties.

In spring 2004 and spring 2005, the varieties sown in fall 2003 were used to assess the grazing preferences of horses. During the first week of grazing in both years, variety plots were measured for forage height and scored for forage density and evidence of grazing. Measurements were made before horses were given access

Table 2. Preference rankings determined in the first week of grazing in Spring 2004 and Spring 2005 for cool season grass varieties sown September 17, 2003 at Lexington, Kentucky.

Variety	Species	Preference Rank ¹		2-yr Rank ²	Percent Stand Oct. 25, 2007 ³
		Spring 2004	Spring 2005		
Haymate	orchardgrass	2	1	1	58
Barfleo	timothy	1	6	2	17
Peak	smooth brome	3	4	3	7
KYFA 9819	festulolium	5	3	4	16
Ginger	KY bluegrass	4	5	5	54
TM 9901	timothy	8	2	6	17
KYFA 0006	tall fescue	7	7	7	74
KYFA 9602	tall fescue	6	11	8	37
KYFA 9611	tall fescue	9	8	9	61
KYFA 9304	tall fescue	10	10	10	66
Select	tall fescue	12	12	11	65
KYTF 2	tall fescue	15	9	12	63
KY 31-	tall fescue	11	14	13	69
Common	KY bluegrass	13	13	14	58
AR 1	tall fescue	14	15	15	73

¹ 1=most preferred, 15=least preferred; see text for explanation of ranking process.

² 1=most preferred based on 2-year total; when two varieties had the same 2-year total, ties were broken using the 2004 rank.

³ Stand survival after 4 years of continuous grazing.

Table 3. Seedling vigor, grazing preference and stand persistence of forage grasses sown September 3, 2004 in a horse grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor ¹ Nov 8, 2004	Grazing Preference ² May 20, 2008	Percent Stand							
				2005		2006		2007		2008	
				Mar 30	Oct 31	Apr 4	Nov 3	Mar 29	Oct 25	Apr 7	Oct 15
Commercial Varieties-Available for Farm Use											
Seine	tall fescue	4.2	3.8	93	100	100	98	98	93	94	93*
Stockman	tall fescue	3.8	2.5	98	98	99	94	93	89	88	86*
Ginger	KY bluegrass	2.2	3.5	88	89	93	91	95	91	93	79*
Select	tall fescue	4.2	2.7	100	99	100	94	91	79	83	68
Haymate	orchardgrass	3.5	8.0	98	98	98	87	63	55	58	55
GrandDaddy	tetraploid perennial ryegrass	5.0	8.8	82	95	98	83	89	60	63	48
Aries	diploid perennial ryegrass	4.7	8.3	13	65	61	32	44	33	18	18
Express	timothy	1.8	8.2	50	53	53	37	42	13	20	9
Experimental Varieties											
KYPP 9901	KY bluegrass	2.0	4.8	93	98	98	97	98	96	99	93*
KYFA 9304	tall fescue	4.2	4.7	100	100	100	97	98	92	94	91*
KYFA 9811	tall fescue	4.5	4.3	97	100	100	94	95	91	91	88*
KYDG 9303	orchardgrass	4.3	5.5	95	98	99	95	92	83	79	70
KY31E- ³	tall fescue	4.7	2.3	98	99	100	87	88	77	83	69
OG 0204G	orchardgrass	3.7	8.5	98	99	99	95	88	71	70	46
OG 0205G	orchardgrass	3.5	7.7	95	99	98	91	81	72	66	43
94-100	orchardgrass	3.2	8.0	98	99	97	88	73	57	49	28
Mean		3.7	5.7	87.3	93.2	93.3	85.0	83.0	71.9	71.7	61.8
CV,%		15.4	20.2	7.7	7.8	8.4	11.7	18.2	24.4	22.0	29.0
LSD,0.05		0.7	1.3	7.7	8.3	9.0	11.5	17.3	20.2	18.2	20.5

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth

² Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed.

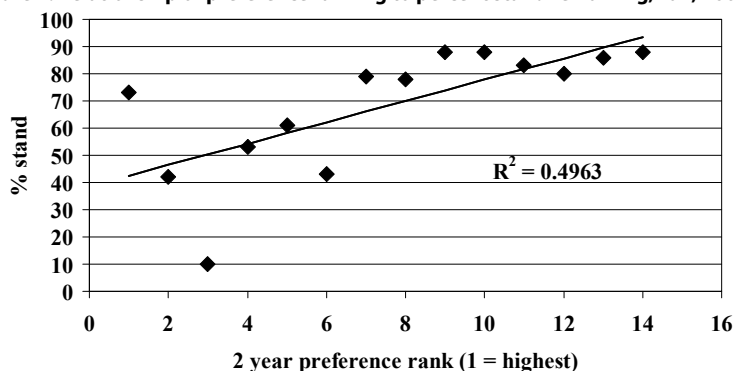
³ KY31E- is the variety of KY31 where the toxic endophyte has been removed. All other fescue varieties in this test do not contain an endophyte.

*Not significantly different from the highest value in the column, based on the 0.05 LSD.

to plots and on days 2, 5, and 7. Forage density was scored from 0 to 10, where 10 indicated that 100 percent of the plot was covered with the seeded variety and 0 indicated that there were no plants of the seeded variety. Similarly, grazing intensity was scored from 0 to 10; where 10 indicated that 100 percent of the plants had been grazed and 0 indicated that none of the plants had been grazed.

Preference rankings were generated using a combination of measurements including the percent reduction in forage height between day 0 and day 7 (greatest reduction = most preferred); the unit decrease in forage density from day 0 to day 7 (largest unit reduction = most preferred); and the grazing intensity scores from day 7 (highest grazing score = most preferred). The rankings for each characteristic were then totaled and the varieties with the lowest totals were considered most preferred. Table 2 shows the preference rankings determined in spring 2004 and spring 2005 for the forage varieties sown in fall 2003. A two-year ranking was also determined based on the total from the 2004 and 2005 rankings. When two forages had the same two-year total, the tie was broken using the 2004 score. In general, tall fescue varieties were less preferred by horses than timothy and orchardgrass. However, only one variety of orchardgrass was included in this test. Common bluegrass also appeared to have low palatability to horses, although the "Ginger" variety of bluegrass was well accepted. This may have been influenced by maturity.

Figure 1. Relationship of preference ranking to percent stand remaining, Fall, 2006.



Note-species on above figure are as follows:
 1-orchardgrass, 2-timothy, 3-smooth brome, 4-festulolium,
 5-KY bluegrass, 6-timothy, 7-13-tall fescue, 14-KY bluegrass

To determine whether grazing preferences might affect the grazing tolerance of cool-season grass varieties, the relationship of the two-year grazing preference ranking to the percent stand remaining in fall 2006 was plotted in Figure 1. There is a moderate relationship between preference rank and percent stand ($R^2 = 0.49$); least preferred varieties had the highest

percent stand after three grazing seasons. Two varieties appear to have performed differently than the others: "Haymate" orchardgrass had a relatively high stand percentage (73 percent), even though it was highly preferred; the "Peak" variety of smooth brome had an extremely low stand percentage (10 percent) compared to all other varieties.

Table 4. Seedling vigor, grazing preference and stand persistence of forage grasses sown September 9, 2005 in a horse grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor ¹ Nov 10, 2005	Grazing Preference ² May 20, 2008	Percent Stand					
				2006		2007		2008	
				Apr 4	Nov 3	Mar 30	Oct 25	Apr 7	Nov 20
Commercial Varieties-Available for Farm Use									
KY31+ ³	tall fescue	3.8	2.2	98	87	87	83	84	84*
Benchmark Plus	orchardgrass	4.0	4.0	96	93	89	84	81	80*
Jesup MaxQ	tall fescue	2.5	1.0	96	77	65	81	82	78*
Select	tall fescue	3.0	2.2	94	94	92	84	86	63
Persist	orchardgrass	3.2	3.8	89	76	72	68	82	50
Spring Green	festulolium	4.3	8.2	95	69	69	70	71	47
Tekapo	orchardgrass	3.5	8.3	72	78	40	45	51	38
Duo	festulolium	5.0	8.7	100	74	71	58	43	18
Talon	timothy	2.2	7.8	74	39	36	16	26	12
Derby	timothy	2.7	8.2	78	28	28	13	26	9
Summit	timothy	2.3	8.3	86	55	48	18	45	9
Experimental Varieties									
KYFA 9821/AR542	tall fescue	3.5	1.7	98	92	91	92	92	90*
KYFA 9821/AR584	tall fescue	3.3	1.7	96	93	91	93	91	90*
KY31- ³	tall fescue	3.5	2.0	98	93	91	95	92	88*
KYFA 9821	tall fescue	3.5	1.3	98	96	94	90	89	87*
OG0203G	orchardgrass	3.5	6.8	91	81	66	71	81	61
SW ER3575	perennial ryegrass	4.8	8.7	100	97	98	89	86	56
SW ER3508FR1	perennial ryegrass	4.0	9.0	96	83	82	76	75	43
SW ER3579	perennial ryegrass	4.5	9.0	97	91	93	83	73	40
Mean		3.6	5.3	92.6	79.2	75.0	70.3	72.4	56.0
CV,%		17.8	21.3	11.9	20.3	24.1	23.9	23.4	31.3
LSD,0.05		0.8	1.4	13.1	19.3	21.7	20.2	20.6	21.0

¹ Vigor score based on a rating of 1 to 5 with 5 being the most vigorous seedling growth.

² Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed.

³ KY 31 E- is the variety KY 31 where the toxic endophyte has been removed. Jesup MaxQ contains a non-toxic endophyte that provides stand persistence with no animal toxicity. AR584 and AR542 are non-toxic endophytes. KY31+ contains the toxic endophyte. The other fescue varieties in this test do not contain an endophyte.

*Not significantly different from the highest value in the column, based on the 0.05 LSD.

Summary Table

Table 7 summarizes information about distributors and persistence across years for all varieties in these tests. Varieties are listed in alphabetical order, with experimental varieties listed at the bottom. An open block indicates that the variety was not in that particular test (labeled at the top of the column); an "x" in the block indicates the variety was in the test but was significantly different from the most persistent variety. A single asterisk (*) means that the variety was not significantly different from the most persistent variety in that study. It is best to choose a variety that has performed well over several years.

Summary

These studies indicate that there are varieties of cool-season grasses that can tolerate overgrazing by horses for three to four seasons and still maintain reasonable stands. This information should be used along with yield and other information (for example, relative maturity in spring) in selecting the best grass variety for each individual use. It is not generally recommended that tall fescue, orchardgrass, or other cool-season grasses be continuously overgrazed as was done in this trial. Although several varieties expressed tolerance to the level of grazing pressure used in these trials, overgrazing greatly reduces forage production. This information should be an indication of those varieties that will better withstand overgrazing when it occurs.

Good management for maximum life from any grass would be to allow complete establishment before grazing and to avoid overgrazing during times of extreme stress, such as drought.

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Table 5. Seedling vigor, grazing preference and stand persistence of forage grasses sown September 6, 2006 in a horse grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor ¹ Oct 25, 2006	Grazing Preference ² May 20, 2008	Percent Stand				
				2006	2007		2008	
				Oct 25	Mar 30	Oct 24	Apr 7	Nov 20
Commercial Varieties-Available for Farm Use								
KY31+ ³	tall fescue	3.0	1.2	100	100	99	100	100*
Select	tall fescue	3.0	1.2	100	100	99	100	98*
Benchmark Plus	orchardgrass	2.5	2.3	99	99	99	99	98*
Ambrosia	orchardgrass	2.2	7.0	98	87	86	91	85
Sulino	festulolium	4.3	8.8	100	100	88	89	63
Ginger	KY bluegrass	1.0	5.0	84	99	91	91	56
Felopa	festulolium	4.5	8.3	100	100	81	89	54
Agula	festulolium	4.3	8.3	100	100	80	88	39
Duo	festulolium	5.0	7.8	98	98	31	35	29
Experimental Varieties								
KYFA 9301/AR584	tall fescue	3.0	1.0	100	100	100	100	100*
KYFA 9821/AR584	tall fescue	3.0	1.0	99	99	99	100	100*
KYFA 9821EF	tall fescue	3.0	1.2	100	100	100	100	100*
KYFA 9821/AR542	tall fescue	2.8	1.0	99	100	99	99	99*
KY31- ³	tall fescue	3.0	1.3	100	100	99	100	98*
KYFA 9304	tall fescue	3.0	1.3	100	100	100	100	98*
B 50815	KY bluegrass	1.0	8.7	100	100	99	100	96*
OG 0203G	orchardgrass	2.2	5.0	99	94	91	91	92*
HTBF 1000	KY bluegrass	1.0	9.0	99	99	94	97	86*
HTBF 2000	KY bluegrass	1.0	8.8	98	99	97	98	86*
B 50336	KY bluegrass	1.0	8.5	99	97	95	96	82
NF 06101	orchardgrass	2.0		100	0	0	0	0
Mean		2.7	4.8	98.7	93.9	86.9	88.7	79.0
CV,%		10.5	15.2	8.1	4.5	6.7	6.0	16.5
LSD,0.05		0.3	0.8	9.1	4.9	6.6	6.1	14.9

¹ Vigor score based on a rating of 1 to 5 with 5 being the most vigorous seedling growth.
² Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed.
³ KY 31 E- is the variety KY 31 where the toxic endophyte has been removed. AR584 and AR542 are non-toxic endophytes. KY31+ contains the toxic endophyte. The other fescue varieties in this test do not contain an endophyte.
 *Not significantly different from the highest value in the column, based on the 0.05 LSD.

Table 6. Seedling vigor and stand persistence of forage grasses sown September 6, 2007 in a horse grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor ¹ Nov 16, 2007	Percent Stand		
			2007	2008	
			Nov 16	Apr 7	Oct 20
Commercial Varieties-Available for Farm Use					
KY31+ ²	tall fescue	4.2	92	93	94*
Benchmark Plus	orchardgrass	3.3	89	84	83*
Throughblue	KY bluegrass	1.3	66	73	80*
Granddaddy	perennial ryegrass	4.3	78	83	71
Barderby	KY bluegrass	1.0	79	74	63
Select	tall fescue	3.0	77	74	60
Nanryo	tall fescue	2.4	65	72	56
Lato	KY bluegrass	1.8	70	71	43
Experimental Varieties					
KYFA 9301/AR584	tall fescue	4.3	91	86	85*
KYFA 9821/AR584	tall fescue	3.7	92	91	85*
BARFA BE9301A	tall fescue	4.0	87	86	84*
KY31- ²	tall fescue	4.2	87	87	82*
Mean		3.3	81.9	81.4	73.9
CV,%		21.5	16.5	19.5	21.6
LSD,0.05		0.9	16.4	18.7	18.8

¹ Vigor score based on a rating of 1 to 5 with 5 being the most vigorous seedling growth.
² KY 31 E- is the variety KY 31 where the toxic endophyte has been removed. AR584 is a non-toxic endophyte. KY31+ contains the toxic endophyte. BARFA BE9301A contains a beneficial endophyte. The other fescue varieties in this test do not contain an endophyte.
 *Not significantly different from the highest value in the column, based on the 0.05 LSD.

