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2009 Cool-Season Grass Grazing Tolerance Report

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Introduction

Cool-season grasses such as tall fescue and orchardgrass are the primary pasture grasses in Kentucky. Other species such as perennial ryegrass, festulolium, and prairie brome can be used in pasture systems. Little is known about the effect of variety on the grazing tolerance of these cool-season grass species.

The purpose of this report is to summarize current research on the grazing tolerance of varieties of tall fescue, orchardgrass, perennial ryegrass, and other species when they are subjected to continuous, heavy grazing pressure by cattle within the grazing season. The main focus will be on plant stand survival. Tables 15, 16, and 17 show the summaries of all tall fescue, orchardgrass and perennial ryegrass varieties tested in Kentucky during the past ten years. The UK Forage Extension website 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

Grass variety tests for grazing tolerance were established in Lexington in the fall of 2005, 2006, 2007 and 2008. The soil at Lexington (Maury) is a well-drained silt loam and is well suited to tall fescue, orchardgrass, and ryegrass production. 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 sown into a prepared seedbed using a disk drill. Grazing began in April and was continuous until late September. Plots were grazed down to below 4 inches quickly by feeder steers or heifers and kept at 2 to 4 inches for the remainder of the grazing season. Supplemental hay or soybean hulls were fed during periods of slowest growth. Animals were removed from plots after all fall growth had been removed and when little regrowth was expected. Visual ratings of percent stand were made in the fall several weeks after the cattle 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 the fall. Other fertilizers (lime, P, and K) were applied as needed according to the University of Kentucky soil test recommendations.

Table 7 shows orchardgrass varieties under rotational grazing. For this trial, the cattle were allowed to graze the grass quickly to about 4 inches and then the cattle were removed. The grass was then allowed to regrow for four to five weeks and then grazed to about 4 inches and the cattle removed. This procedure was repeated throughout the season.

Results and Discussion

Weather data for Lexington is presented in Table 1. Data on percent stand are presented in Tables 2 through 11. Statistical analyses were performed on all entries (including experimentals) to determine if the apparent differences

Table 1. Temperature and rainfall at Lexington, Kentucky in 2006, 2007, 2008 and 2009.

	2006				2007				2008				2009[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	42	+11	4.77	+1.91	37	+6	2.93	+0.07	33	+2	4.60	+1.74	28	-3	2.45	-0.41
FEB	36	+1	2.13	-1.08	27	-8	1.83	-1.38	36	+1	5.37	+2.16	38	+3	2.86	-0.35
MAR	44	0	3.05	-1.35	52	+8	1.97	-2.43	45	+1	6.28	+1.88	48	+4	2.19	-2.21
APR	59	+4	3.52	-0.36	53	-2	3.87	-0.01	55	0	5.72	+1.84	55	0	4.48	+0.60
MAY	62	-2	2.99	-1.48	68	+4	1.45	-3.02	62	-2	4.88	+0.41	64	0	5.05	+0.58
JUN	70	-2	1.82	-1.84	74	+2	1.77	-1.89	74	+2	3.30	-0.36	74	+2	5.41	+1.75
JUL	76	0	5.13	+0.13	74	-2	6.90	+1.90	76	0	2.54	-2.46	71	-5	5.89	+0.89
AUG	76	+1	3.23	-0.70	80	+5	2.56	-1.37	75	0	1.08	-2.85	73	-2	5.38	+1.45
SEP	64	-4	9.27	+6.07	72	+4	1.15	-2.05	72	+4	1.21	-1.99	68	0	5.37	+2.17
OCT	54	-3	4.88	+2.31	63	+6	5.28	+2.71	57	0	1.35	-1.22	54	-3	4.83	+2.26
NOV	47	+2	1.78	-1.61	46	+1	2.86	-0.53	43	-2	2.28	-1.11	49	+4	0.94	-2.45
DEC	42	+6	2.45	-1.53	40	+4	5.29	+1.31	35	-1	4.76	+0.78				
Total			45.02	+0.47			37.86	-6.69			43.37	-1.18			44.85	+4.28

[1] DEP is departure from the long-term average.
[2] 2009 data is for eleven months through November.

Table 2. Seedling vigor, grazing preference and stand persistence of tall fescue and festulolium (FL) varieties sown September 8, 2005 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]			Percent Stand							
	2005	2007	2008	2009	2006		2007		2008		2009	
Variety	Nov 7	May 19	May 16	May 14	Apr 17	Oct 20	Mar 30	Oct 16	Apr 9	Oct 15	Apr 9	Oct 12
Commercial Varieties—Available for Farm Use												
KY31+[3]	3.5	3.0	3.2	1.2	96	96	98	97	96	94	96	96*
BarOptima PLUS E34	2.7	4.5	5.8	4.7	85	88	91	89	90	93	87	96*
Barolex	2.8	4.3	5.8	7.2	86	90	93	88	89	89	68	75
Barianne	1.3	5.2	6.0	7.2	57	68	73	74	79	83	66	72
Jesup MaxQ	2.3	2.3	2.3	3.0	87	91	95	91	93	92	46	65
Select	1.8	2.3	2.8	1.8	83	90	93	92	93	93	50	64
Duo (FL)	3.8	8.2	9.0	–	97	84	90	88	46	25	1	1
SpringGreen (FL)	3.7	8.7	9.0	–	96	91	94	93	88	66	1	0
Experimental Varieties												
AGRFA 144	2.8	2.2	2.5	2.2	89	92	95	93	93	93	76	84*
KYFA 9821/AR584	3.2	2.3	2.7	2.7	93	94	96	94	92	92	82	83*
KYFA 9821/AR542	3.2	2.7	3.0	2.8	94	95	97	96	96	94	75	83*
KYFA 9301/AR542	3.5	2.5	3.5	2.0	94	95	96	96	96	96	77	82*
TF 0101	2.5	2.0	3.5	3.7	92	92	93	92	89	88	74	82*
KYFA 9821EF	2.8	2.0	3.0	3.0	92	93	96	94	94	93	78	80*
KY31-[3]	3.0	2.3	2.7	2.5	94	95	96	95	95	93	78	79
KYFA 9301/AR584	3.8	2.5	2.7	3.2	94	96	97	95	95	95	76	76
AGRFA 148	2.8	2.5	2.2	2.3	94	95	97	95	96	93	64	73
IS-FTF 25	2.5	2.0	2.3	1.2	84	92	94	92	91	92	69	72
TF 0203G	2.3	1.8	2.2	2.8	92	93	95	95	93	93	63	72
TF 9801	2.0	2.7	2.3	2.2	81	84	88	88	89	88	68	68
KYFA 9301 EF	2.7	1.8	4.3	4.7	88	93	94	94	92	92	66	62
IS-FTF 12	1.8	2.2	2.8	4.2	83	87	88	86	89	88	45	52
KYFA 9304 EF	2.7	2.5	4.5	4.2	87	89	91	89	88	84	41	43
UMTF	0.8	5.3	6.3	5.7	13	17	26	24	32	32	8	6
Mean	2.7	3.2	3.9	3.3	85.4	87.4	91.0	88.7	87.2	85.0	60.5	65.1
CV,%	26.0	25.0	22.7	48.2	8.2	8.2	6.7	6.0	7.2	7.5	23.5	22.2
LSD,0.05	0.8	0.9	1.0	2.1	8.0	8.2	6.9	6.1	7.2	7.3	15.2	16.6

[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. Grazing time before rating: 2007-25 days, 2008-17 days, 2009-16 days. Stand thinning may have been greater for preferred varieties due to closer grazing.
[3] "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

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.

Kentucky 31 tall fescue with the endophyte (KY31+) is considered to be the most grazing-tolerant variety and was the grazing-tolerant check entry in all tall fescue trials. The central questions in grazing tolerance among tall fescues are:

1. Can endophyte-free varieties persist as well as KY31+; and
2. Will the new novel, or "friendly," endophyte materials persist as well as other tolerant varieties?

After three and four seasons, several fescue varieties were comparable to KY31+ in regard to grazing tolerance (Tables 2 and 3).

Table 12 (fescue and festulolium), Table 13 (orchardgrass), and Table 14 (perennial ryegrass and festulolium) summarize information about distributors and persistence across locations and 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 plant survival was significantly less than the most persistent variety. A single asterisk (*) means that the variety was not significantly different from the most persistent variety in that study based on the 0.05 LSD.. It is best to choose a variety that has performed well over several years.

Tables 15, 16, and 17 are summaries of stand persistence data from 1996 to 2009 of commercial tall fescue, orchardgrass, and perennial ryegrass varieties that have been entered in the Kentucky trials. In Table 15 the data is listed as a percentage of KY31+. In other words, in the tall fescue trials KY31+ is 100 percent. Varieties with percentages over 100 persisted better than KY31+, and varieties with percentages less than 100 persisted less than KY31+. In Tables 16 and 17 the data is listed as a percentage of the mean of the commercial varieties entered in each specific trial. In other words, the mean for

Table 3. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 8, 2006 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]			Percent Stand						
	2006	2007	2008	2009	2006	2007		2008		2009	
variety	Oct 25	May 19	May 16	May 14	Oct 25	Mar 30	Oct 15	Apr 9	Oct 17	Apr 8	Oct 12
Commercial Varieties—Available for Farm Use											
KY31+[3]	3.8	5.3	4.3	1.3	100	100	100	100	100	100	100*
Jesup MaxQ	2.7	3.2	2.0	2.0	99	100	100	100	100	96	99*
Tuscany II	2.8	4.8	3.3	3.3	99	100	100	100	100	96	99*
Select	3.3	2.7	2.7	3.7	100	100	100	100	100	91	96*
Verdant	3.2	6.0	3.5	4.2	99	99	98	97	98	88	90*
Advance MaxQ	3.2	7.8	4.3	5.2	99	98	98	98	99	87	88
Barolex	3.3	6.5	6.8	4.7	100	100	100	100	100	98	69
Bariane	2.5	8.5	8.3	8.4	96	100	99	100	99	42	40
Experimental Varieties											
AGRFA 148	3.7	2.2	1.8	1.3	100	100	100	100	100	100	100*
KYFA 9301/AR542	4.2	4.3	2.8	1.7	100	100	100	100	100	100	100*
KYFA 9301/AR584	4.2	4.0	2.2	1.0	100	100	100	100	100	100	100*
KYFA 9821/AR584	4.0	2.8	2.7	1.5	100	100	100	100	100	100	100*
AGRFA 140	3.8	2.5	1.0	1.2	100	100	100	100	100	98	100*
AGRFA 144	3.7	1.3	1.3	1.0	100	100	85	100	100	98	100*
AGRFA 121	3.5	3.8	1.3	1.2	100	100	100	100	100	97	99*
KY31-[3]	4.2	4.0	2.5	2.3	100	100	100	100	100	98	99*
TF 0202	3.2	6.2	5.3	4.5	99	100	100	100	100	98	99*
AGRFA 120	3.7	3.5	1.3	1.3	100	100	100	100	99	95	99*
AGRFA 155	3.3	4.7	2.0	1.2	99	98	99	99	99	98	99*
FA 2864	3.2	6.2	4.3	3.0	99	99	99	99	99	97	99*
KYFA 9301EF	3.7	4.0	3.3	2.0	99	100	100	100	100	98	99*
KYFA 9304	3.8	5.2	4.0	4.3	100	100	100	100	100	93	99*
K6560QII542	3.0	8.0	2.0	1.5	100	99	98	99	98	98	99*
AGRFA 156	3.2	4.7	2.0	2.2	100	100	99	100	100	89	98*
K5666VII	2.7	7.0	4.8	6.3	99	100	99	99	99	93	96*
FA2865	3.7	6.0	3.7	3.3	99	100	98	98	99	95	96*
FA2863	3.3	5.2	3.7	5.7	99	100	100	99	99	91	96*
KFa402V542	3.0	6.2	2.7	4.8	99	100	100	100	100	93	95*
K4508Q542	3.3	5.7	1.0	1.3	99	100	100	100	99	90	94*
FA 2862	2.7	4.0	2.8	3.3	99	100	100	100	99	94	94*
K4508Q	2.5	6.8	1.5	2.2	98	100	99	100	99	94	94*
Mean	3.4	4.9	3.1	2.9	99.3	99.7	99.1	99.6	99.5	93.6	94.6
CV,%	20.4	28.6	29.9	52.2	1.3	0.9	6.7	1.3	1.3	8.5	10.9
LSD,0.05	0.8	1.6	1.1	1.7	1.5	1.0	7.6	1.5	1.5	9.0	11.7

[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. Grazing time before rating; 2007-25 days, 2008-17 days, 2009-16 days. Stand thinning may have been greater for preferred varieties due to closer grazing.
[3] "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

each trial is 100 percent. Varieties with percentages over 100 persisted better than average, and varieties with percentages less than 100 persisted less than average. Direct, statistical comparisons of varieties cannot be made using the summary Tables 15, 16, and 17, but these comparisons do help to identify varieties for further consideration. Varieties that have performed better than average over many years have very stable performance; others may have performed very well in wet years or on particular soil types. These details may influence variety choice, and the information can be found in the yearly reports. See footnote in Tables 15, 16, and 17 to determine which yearly report to refer to.

Summary

These studies indicate that there are varieties of cool-season grasses that can tolerate overgrazing for multiple seasons and still maintain reasonable stands. Some varieties of endophyte-free as well as novel, or "friendly," endophyte tall fescue have been able to maintain equivalent stands to endophyte-infected KY31. There is no "KY31+" equivalent in orchardgrass; that is, no variety has historically been proven to be tolerant of overgrazing. However, some varieties have exhibited good tolerance to grazing abuse even after three and four seasons.

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 recommended that tall fescue or orchardgrass be continuously overgrazed as was done in these trials. Although several varieties expressed tolerance to the level of grazing pressure used in these trials, overgrazing greatly reduces yield and therefore profitability of these varieties. This information should be an indication of those varieties

that will better withstand the occasional overgrazing that sometimes becomes necessary in livestock operations.

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

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Table 4. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 5, 2007 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]		Percent Stand				
	2007	2008	2009	2007	2008		2009	
Variety	Nov 7	May 16	May 14	Nov 7	Apr 9	Oct 17	Apr 8	Oct 12
Commercial Varieties—Available for Farm Use								
BarElite	3.3	6.0	3.3	97	97	98	98	99*
BarOptima PLUS E34	3.5	5.8	2.0	98	98	99	98	99*
KY31+[3]	3.2	6.0	1.0	96	96	97	98	98*
Nanryo	3.2	1.8	1.0	98	98	79	97	98*
Select	2.1	3.7	1.0	92	93	94	94	96*
Jesup MaxQ	1.5	5.7	1.0	94	92	92	93	94*
Barolex	2.3	6.8	3.2	91	89	91	91	90*
Bariane	1.7	6.5	7.2	84	89	87	86	89
Experimental Varieties								
KRC 6581	4.2	5.0	1.5	99	100	100	100	100*
KYFA 9301/AR584	3.2	4.8	1.0	98	98	99	99	100*
AGRFA 140	2.8	2.3	1.0	95	97	97	99	99*
KYFA 9821	3.3	2.8	1.0	96	96	98	99	99*
KY31-[3]	4.2	3.5	1.0	99	99	99	98	99*
KYFA 9821/AR584	3.7	3.7	1.0	99	99	99	99	99*
BARFA MT9301	3.0	5.8	2.2	95	96	97	98	98*
FA 2866	4.3	2.5	1.3	99	98	97	96	97*
AGRFA 144	1.7	7.2	1.0	98	97	96	96	96*
AGRGT 159	2.7	4.0	1.0	96	96	95	96	96*
AGRGT 160	2.7	4.3	1.2	97	97	96	96	95*
KYFA 9301	3.2	4.3	1.2	97	94	96	95	95*
KYFA 9611	3.3	7.8	4.2	95	95	96	92	94*
KRC 6582	3.0	7.2	4.8	97	96	95	95	92*
AGRFA 111	3.2	7.0	2.7	97	96	90	85	85
KRC 6580	1.0	8.3	1.3	59	47	65	68	70
AGRFA 156	1.8	7.8	1.5	91	78	75	62	62
Mean	2.9	5.2	1.9	94.3	93.1	93.1	93.0	93.4
CV,%	20.4	21.9	32.2	7.6	5.8	10.0	9.1	9.4
LSD,0.05	0.7	1.3	0.7	8.4	6.3	10.9	9.9	10.3

[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. Grazing time before rating: 2008-17 days, 2009-16 days. Stand thinning may have been greater for preferred varieties due to closed grazing.
[3] "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 5. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 11, 2008 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]	Percent Stand		
	2008	2009	2008	2009	
Variety	Oct 13	May 14	Oct 13	Apr 8	Oct 12
Commercial Varieties—Available for Farm Use					
HyMark	3.8	2.8	99	100	100*
KY31+[3]	2.5	6.8	98	100	100*
Select	3.3	2.2	98	100	100*
JesupMaxQ	2.3	8.8	98	87	89
Experimental Varieties					
KYFA9301/AR584	4.7	2.7	100	100	100*
KYFA9821/AR584	3.5	3.7	100	100	100*
TF0201	2.5	6.2	100	99	100*
KY31-[3]	2.5	4.3	98	99	100*
AGRFA144	2.5	3.7	98	98	99*
NFTF1070	2.8	4.5	99	99	98*
GA-186	3.7	6.0	100	96	97*
GA-593R	3.3	4.2	100	96	97*
Mean	3.1	4.7	99.0	97.8	98.4
CV,%	24.9	41.0	2.4	5.2	4.2
LSD,0.05	0.9	2.2	2.7	5.9	4.7

[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. Grazing time before rating-16 days.
[3] "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Seedling vigor, grazing preference and stand persistence of orchardgrass varieties sown September 8, 2005 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]			Percent Stand							
	2005	2007	2008	2009	2006		2007		2008		2009	
Variety	Nov 7	May 25	May 16	May 8	Apr 17	Oct 20	Mar 30	Oct 16	Apr 8	Oct 15	Apr 9	Oct 12
Commercial Varieties—Available for Farm Use												
BenchmarkPlus	3.7	3.5	4.5	4.3	96	96	98	93	95	93	86	86*
Persist	2.8	3.5	4.2	4.0	95	95	99	96	98	97	87	78*
Athos	2.5	6.8	7.8	7.2	93	97	95	95	91	91	39	34
Tekapo	3.0	7.3	7.8	8.3	94	97	80	88	86	83	29	28
Experimental Varieties												
IS-OG28	3.5	4.7	6.0	5.5	96	95	98	97	97	95	88	88*
AGRDG101	3.3	8.8	8.2	6.0	75	81	33	29	18	17	4	1
Mean	3.1	5.8	6.4	5.6	91.4	93.3	83.8	92.9	80.8	79.4	55.5	52.3
CV,%	18.4	17.0	8.0	18.3	4.7	5.6	9.5	9.8	5.0	5.0	21.0	22.6
LSD,0.05	0.7	1.2	0.6	1.8	5.2	6.2	9.4	9.7	40.8	4.7	13.9	14.1

[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. Grazing time before rating: 2007-25 days, 2008-17 days, 2009-16 days. Stand thinning may have been greater for preferred varieties due to closer grazing.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 7. Seedling vigor, grazing preference and stand persistence of orchardgrass varieties sown September 22, 2005 in a cattle grazing tolerance study at Lexington, Kentucky (rotational grazing).

	Seedling Vigor[1]	Grazing Preference[2]			Percent Stand							
	2005	2007	2009		2006		2007		2008		2009	
Variety	Nov 7	May 25	May 8	Jun 12	Apr 17	Oct 20	Mar 30	Oct 16	Apr 9	Oct 15	Apr 9	Oct 12
Commercial Varieties—Available for Farm Use												
Athos	3.0	5.7	7.3	7.0	94	98	94	94	93	92	91	92*
BenchmarkPlus	3.3	2.8	3.7	4.2	95	97	96	88	93	93	95	89*
Persist	3.0	2.5	3.8	4.0	96	98	98	91	95	93	93	89*
Tekapo	3.0	5.3	5.5	5.0	92	95	86	87	87	87	87	86*
Experimental Varieties												
IS-OG28	2.7	3.0	5.7	5.3	94	97	98	93	93	94	95	94*
AGRDG101	3.3	8.5	7.8	6.2	67	85	28	38	25	23	22	24
Mean	3.1	4.6	5.6	5.3	89.6	94.7	83.2	81.8	80.9	80.1	80.4	79.0
CV,%	21.2	23.1	13.3	31.0	8.6	4.0	11.6	12.9	9.3	7.8	5.3	8.1
LSD,0.05	0.8	1.3	0.9	1.9	9.2	4.5	11.4	12.5	9.0	7.5	5.1	8.4

[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 grazed. Grazing time before rating: 2007-2 days, First 2009-5 days, Second 2009-one half day.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 8. Grazing preference and stand persistence of orchardgrass varieties sown April 8, 2008 in a cattle grazing preference study at Lexington, Kentucky (continuous grazing).

	Grazing Preference[1]	Percent Stand			
	2009	2008		2009	
Variety	May 14	Jul 17	Oct 17	Apr 8	Oct 12
Commercial Varieties—Available for Farm Use					
Persist	3.0	99	98	97	97*
Benchmark Plus	2.8	98	96	96	95*
Ambrosia	8.2	97	96	93	94*
Seco	6.5	96	95	95	93*
Harvestar	8.3	98	97	94	92*
Tekapo	6.7	98	96	84	90
Experimental Varieties					
OG0203G	4.8	97	97	94	96*
Mean	5.8	97.6	96.2	94.1	94.0
CV,%	20.3	3.2	2.8	7.5	6.4
LSD,0.05	1.4	3.8	3.4	8.4	7.2

[1] Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating-16 days.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 9. Seedling vigor, grazing preference and stand persistence pf perennial ryegrass varieties sown September 8, 2005 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]		Percent Stand						
	2005	2007	2008	2006		2007		2008		2009
Variety	Nov 7	May 25	May 16	Apr 17	Oct 20	Mar 30	Oct 16	Apr 9	Nov 20	Apr 9
Commercial Varieties—Available for Farm Use										
BG34	3.2	6.0	8.0	96	97	97	93	89	81*	0[3]
Quartet	4.7	9.0	8.8	93	94	63	58	28	29	0
Tonga	3.5	8.0	8.8	97	96	97	91	40	28	0
Experimental Varieties										
SWER3508FRI	2.8	8.0	8.8	94	97	98	94	81	72*	0
SWER3575	3.3	8.0	7.8	95	96	97	94	78	66*	0
SWER3579	3.7	8.0	8.5	97	96	97	93	76	58	0
Mean	3.5	7.8	8.5	95.4	95.9	91.7	87.3	65.1	55.6	
CV,%	14.3	0.0	7.5	2.1	2.5	6.4	4.4	22.0	28.4	
LSD,0.05	0.6	0.0	0.8	2.4	2.8	7.0	4.5	17.0	18.8	

[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. Grazing time before rating: 2007-25 days, 2008-17 days.
[3] Due to winterkill there was not enough ryegrass greenup to get a stand rating.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 10. Seedling vigor, grazing preference and stand persistence of perennial ryegrass and festulolium (FL) varieties sown September 5, 2007 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]		Percent Stand				
	2007	2008	2009	2007	2008		2009	
Variety	Nov 7	May 16	May 14	Nov 7	Apr 9	Oct 17	Apr 8	Oct 12
Commercial Varieties-Available for Farm Use								
BG34	2.3	9.0	7.8	98	98	96	88	88*
Power	2.3	8.3	8.0	98	98	95	86	87*
Granddaddy	2.3	8.8	6.3	98	96	92	80	80
Quartet	4.5	8.8	8.0	98	88	81	16	14
Experimental Varieties								
KRC 6554	2.7	8.8	7.0	100	100	100	98	99*
KRC 6575	2.8	9.0	7.2	99	100	99	94	97*
KRC 6577	3.7	9.0	7.2	100	100	99	95	95*
KRC 6578	3.5	9.0	7.7	99	99	99	93	94*
KRC 6579	3.4	9.0	8.2	99	99	99	86	91*
GO-ABS	3.2	8.5	7.2	100	100	98	73	88*
GO-ABZ	3.7	8.5	8.0	99	100	100	74	84
KLp401	3.5	9.0	8.0	99	99	97	79	83
KRC 6576	2.3	9.0	7.7	99	98	96	85	82
KYF A0236 (FL)	4.5	7.3	8.5	99	100	98	82	81
GO-ABM	2.3	8.5	7.5	96	94	94	73	75
KLp507	4.4	9.0	8.5	100	100	99	69	63
KYFA 9819 (FL)	1.8	8.8	7.2	96	83	83	63	44
Mean	3.1	8.7	7.6	98.5	97.2	95.6	78.4	79.1
CV,%	19.7	5.7	14.4	1.6	4.4	4.7	17.7	14.7
LSD,0.05	0.7	0.6	1.3	1.8	4.9	5.1	16.0	13.4

[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. Grazing time before rating: 2008-17 days, 2009-16 days.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 11. Seedling vigor, grazing preference and stand persistence of perennial ryegrass, festulolium (FL) and tall fescue (TF)varieties sown September 16, 2008 in a cattle grazing tolerance study at Lexington, Kentucky (continuous grazing).

	Seedling Vigor[1]	Grazing Preference[2]	Percent Stand		
	2008	2009	2008	2009	
Variety	Oct 13	May 14	Oct 13	Apr 8	Oct 12
Commercial Varieties—Available for Farm Use					
Boost	3.8	7.3	99	100	100*
Granddaddy	3.2	7.5	82	100	100*
Linn	3.5	5.8	98	100	100*
SpringGreen (FL)	3.7	7.7	98	100	100*
Duo (FL)	5.0	6.0	99	97	95
Experimental Varieties					
AGRFA 174 (TF)	1.8	5.2	96	97	99*
Mean	3.5	6.6	95.3	99.1	99.1
CV,%	11.9	16.0	15.3	1.5	1.6
LSD,0.05	0.5	1.3	17.3	1.9	2.0

[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. Grazing time before rating-16 days.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 12. Summary of persistence of tall fescue and festulolium (FL) varieties under heavy grazing pressure across years at Lexington, Kentucky.[1]

Variety	Proprietor/ KY Distributor	2005[2]								2006						2007				2008	
		Apr	Oct	Mar	Oct	Apr	Oct	Apr	Oct	Mar	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct
		2006[3]		2007		2008		2009		2007		2008		2009		2008		2009		2009	
Commercial Varieties—Available for Farm Use																					
Advance MaxQ	Pennington Seed									x[5]	*	x	x	x	x						
BarElite	Barenbrug USA															*	*	*	*		
Bariane	Barenbrug USA	x	x	x	x	x	x	x	x	*	*	*	*	x	x	x	x	x	x		
Barolex	Barenbrug USA	x	*	*	x	*	*	x	x	*	*	*	*	*	x	x	*	*	*		
BarOptima PLUS E34	Barenbrug USA	x	*	*	x	*	*	*	*							*	*	*	*		
Duo (FL)	Ampac Seed Company	*	x	x	x	x	x	x	x												
HyMark	Fraser Seeds																			*	*
Jesup Max Q	Pennington Seed	x	*	*	x	*	*	x	x	*	*	*	*	*	*	x	*	*	*	x	x
KY 31+[4]	KY Agric. Exp. Station	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nanryo	Japanese Grassland Forage Seed/ USDA-ARS,ElReno, OK															*	x	*	*		
Select	FFR/Southern States	x	*	*	*	*	*	x	x	*	*	*	*	*	*	x	*	*	*	*	*
Spring Green (FL)	Rose Agri-Seed	*	*	*	*	x	x	x	x												
Tuscany II	Seed Research of Oregon									*	*	*	*	*	*						
Verdant	Amer. Grass Seed Prod.									*	*	x	x	x	*						
Experimental Varieties																					
AGRFA 111	AgResearch (USA)															*	*	x	x		
AGRFA 120	AgResearch (USA)									*	*	*	*	*	*						
AGRFA 121	AgResearch (USA)									*	*	*	*	*	*						
AGRFA 140	AgResearch (USA)									*	*	*	*	*	*	*	*	*	*		
AGRFA 144	Noble Foundation/ AgResearch (USA)	*	*	*	*	*	*	x	*	*	x	*	*	*	*	*	*	*	*	*	*
AGRFA 148	Noble Foundation/ AgResearch (USA)	*	*	*	*	*	*	x	x	*	*	*	*	*	*						
AGRFA 155	AgResearch (USA)									x	*	x	*	*	*						
AGRFA 156	AgResearch (USA)									*	*	*	*	x	*	x	x	x	x		
AGRGT 159	AgResearch (USA)															*	*	*	*		
AGRGT 160	AgResearch (USA)															*	*	*	*		
BARFAMT 9301	Barenbrug USA															*	*	*	*		
FA 2862	AgResearch (USA)									*	*	*	*	*	*						
FA 2863	AgResearch (USA)									*	*	x	*	*	*						
FA 2864	AgResearch (USA)									*	*	x	*	*	*						
FA 2865	AgResearch (USA)									*	*	x	*	*	*						
FA 2866	AgResearch (USA)															*	*	*	*		
GA-186	Univ. of Georgia																			*	*
GA-593R	Univ. of Georgia																			*	*
IS-FTF12	DLF International Seeds	x	x	x	x	*	x	x	x												
IS-FTF25	DLF International Seeds	x	*	*	*	*	*	x	x												
K4508Q	AgResearch (USA)									*	*	*	*	*	*						
K4508Q542	AgResearch (USA)									*	*	*	*	x	*						
K5666VII	AgResearch (USA)									*	*	x	*	*	*						
K6560QII542	AgResearch (USA)									*	*	x	x	*	*						
KFa402V542	AgResearch (USA)									*	*	*	*	*	*						
KY 31-[4]	KY Agric. Exp. Station	*	*	*	*	*	*	x	x	*	*	*	*	*	*	*	*	*	*	*	*
KYFA 9301	KY Agric. Exp. Station	x	*	*	*	*	*	x	x	*	*	*	*	*	*	*	*	*	*		
KYFA 9301/AR542	KY Agric. Exp. Station	*	*	*	*	*	*	x	*	*	*	*	*	*	*						
KYFA 9301/AR584	KY Agric. Exp. Station	*	*	*	*	*	*	x	x	*	*	*	*	*	*	*	*	*	*	*	*
KYFA 9304	KY Agric. Exp. Station	x	*	*	x	x	x	x	x	*	*	*	*	*	*						
KYFA 9611	KY Agric. Exp. Station															*	*	*	*		
KYFA 9821	KY Agric. Exp. Station	*	*	*	*	*	*	x	x							*	*	*	*		
KYFA 9821/AR542	KY Agric. Exp. Station	*	*	*	*	*	*	x	*												
KYFA 9821/AR584	KY Agric. Exp. Station	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
KRC 6580	AgResearch (USA)															x	x	x	x		
KRC 6581	AgResearch (USA)															*	*	*	*		
KRC 6582	AgResearch (USA)															*	*	*	*		
NFTF 1070	Noble Foundation																			*	*
TF0101	FFR/Southern States	*	*	*	*	*	x	x	*												
TF0201	Winfield Solutions LLC																			*	*
TF0202	Allied Seed									*	*	*	*	*	*						
TF0203G	FFR/Southern States	*	*	*	*	*	*	x	x												
TF9801	FFR/Southern States	x	x	x	x	*	*	x	x												
UMTF	Univ. of Manitoba	x	x	x	x	x	x	x	x												

[1] For detailed stand ratings over years, see individual trial tables.
[2] Establishment year.
[3] Date of rating of percent stand.
[4] "+" indicates variety is endophyte infected, "-" indicates variety is endophyte free.
[5] X in the block indicates the variety was in the test but plant survival was significantly less than the most persistent variety. An open block indicates the variety was not in the test,
* Not significantly different from the most persistent variety in the test.

Table 13. Summary of persistence of orchardgrass varieties under heavy grazing pressure across years at Lexington, Kentucky.

		2005[1]								2008[2]			
		Apr	Oct	Mar	Oct	Apr	Oct	Apr	Oct	Jul	Oct	Apr	Oct
Variety	Proprietor/KY Distributor	2006[3]		2007		2008		2009		2008		2009	
Commercial Varieties—Available for Farm Use													
Ambrosia	Amer. Grass Seed Producers									*	*	*	*
Athos	DLF-Jenks	*	*	*	*	x[4]	x	x	x				
Benchmark Plus	FFR/Southern States	*	*	*	*	*	*	*	*	*	*	*	*
Harvestar	Columbia seeds									*	*	*	*
Persist	Smith Seed Services	*	*	*	*	*	*	*	*	*	*	*	*
Seco	FFR/Southern States									*	*	*	*
Tekapo	Ampac Seed Co.	*	*	x	*	x	x	x	x	*	*	x	x
Experimental Varieties													
AGRDG101	AG Research USA	x	x	x	x	x	x	x	x				
IS-OG28	DLF International	*	*	*	*	*	*	*	*				
OG0203G	FFR/Southern States									*	*	*	*

[1] Establishment year.
[2] This trial was replanted in April 2008 due to poor establishment in the fall of 2007.
[3] Date of visual rating of percent stand.
[4] X in the block indicate the variety was in the test but stand survival was significantly less than the most persistent variety. Open blocks indicate the variety was not in the test.
* Not significantly different from the most persistent variety.

Table 14. Summary of persistence of perennial ryegrass and festulolium (FL) varieties under heavy grazing pressure across years at Lexington, Kentucky.

		2005[1]						2007			
	Proprietor/KY	Apr	Oct	Mar	Oct	Apr	Nov	Apr	Oct	Apr	Oct
Variety	Distributor	06[2]	06	07	07	08	08	2008		2009	
Commercial Varieties—Available for Farm Use											
BG34	Barenbrug USA	*	*	*	*	*	*	*	*	*	*
Boost	Allied Seed										
Duo (FL)	Ampac Seed Co.										
Granddaddy	Smith Seed							*	x[3]	x	x
Linn	Public										
Power	Ampac Seed Co.							*	*	*	*
Quartet	Ampac Seed Co.	x	x	x	x	x	x	x	x	x	x
SpringGreen (FL)	Rose Agri-Seed										
Tonga	Kings AgriSeeds	*	*	*	*	x	x				
Experimental Varieties											
GO-ABM	Grassland Oregon							x	x	x	x
GO-ABS	Grassland Oregon							*	*	x	*
GO-ABZ	Grassland Oregon							*	*	x	x
KRC 6554	AgResearch (USA)							*	*	*	*
KRC 6575	AgResearch (USA)							*	*	*	*
KRC-6576	AgResearch (USA)							*	*	*	x
KRC 6577	AgResearch (USA)							*	*	*	*
KRC 6578	AgResearch (USA)							*	*	*	*
KRC 6579	AgResearch (USA)							*	*	*	*
KLp401	AgResearch (USA)							*	*	x	x
KLp507	AgResearch (USA)							*	*	x	x
KYFA 0236 (FL)	KY Agric.Exp. Station							*	*	*	x
KYFA 9819 (FL)	KY Agric.Exp. Station							x	x	x	x
SW ER3508FRI	SW Seed Ltd.	x	*	*	*	*	*				
SW ER3575	SW Seed Ltd.	*	*	*	*	*	*				
SW ER3579	SW Seed Ltd.	*	*	*	*	*	x				

[1] Establishment year.
[2] Date of visual rating of percent stand.
[3] X in the block indicates the variety was in the test but plant survival was significantly less than the most persistent variety. An open block indicates the variety was not in the test.
* Not significantly different from the most persistent variety.

Table 15. Summary of 1996-2009 Kentucky Tall Fescue Grazing Tolerance Trials (stand persistence shown as a percent of the stand rating of KY 31+).

		Lexington											Princeton	
		1996[1,2]	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2002	Mean[3]
Variety	Proprietor	3yr[4]	4yr	3yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	4yr	(#trials)
Advance MaxQ	Pennington Seed											88		–
Bariane	Barenbrug USA								89		75	40		68(3)
Barcel	Barenbrug USA	92												–
Barolex	Barenbrug USA										78	69		74(2)
BarOptima PLUS E34	Barenbrug USA										100			–
BAR9TMPO	Barenbrug USA				75									–
Bronson	Ampac Seed			39										–
Cattle Club	Green Seed		37	98	70	93	91							78(2)
Carmine	DLF-Jenks						90							–
Cowgirl	Rose Agri-Seed									99				–
Dovey	Barenbrug USA	92												–
Festival	Pickseed West						100	101					89	97(3)
Festorina	Advanta Seeds	98	86		57									80(3)
Fuego	Advanta Seeds			27										–
Hoedown	DLF-Jenks					88								–
Jesup EF	Pennington Seed		63	91					99					84(3)
Jesup MaxQ	Pennington Seed			114	79			103	97		68	99	105	95(7)
Johnstone	Proseeds		65	107			92							88(3)
KY31+	KY Agri. Exp Sta.	100	100	100	100	100	100	100	100	100	100	100	100	100(12)
KY31-	KY Agri. Exp Sta.	94	90	102	84		98	103	98	100	82	99	105	96(11)
Kenhy	Public			116										–
Kokanee	Ampac Seed					43								–
Martin II	International Seeds		59											–
Maximize	Rose Agri-Seed						99							–
Orygun								99						–
Resolute	Ampac Seed						23							–
Select	FFR/Sou. St.			109	69	107	101	100	100		67	96	98	94(9)
Southern Cross			25											–
Stargrazer	FFR/Sou. St.	90			52	86	89							79(4)
Stockman	Seed Res. of OR									102				–
TF33	Barenbrug USA			34										–
Tuscany II	Seed Res. of OR											99		–
Verdant	Am.Grass Seed											90		–
Vulcan	International Seeds			109										–

[1] Year trial was established.
[2] Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in stand persistence between varieties. To find actual persistence ratings, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in in 1997 was grazed 4 years so the final report would be "2001 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage website at <www.uky.edu/Ag/Forage>.
[3] Mean only presented when respective variety was included in two or more trials.
[4] Number of years of data.

Table 16. Summary of 1996-2009 Kentucky Orchardgrass Grazing ToleranceTrials (stand persistence shown as a percent of the mean of the commercial varieties in the trial).

		Lexington										Princeton	
		1996[1,2]	1997	1998	1999	2000	2001	2002	2003	2004	2005	2002	Mean[3]
Variety	Proprietor	3yr[4]	4yr	3yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	(#trials)
Abertop	Pennington Seed							38					–
Albert	Univ. of Wisconsin						115						–
Amba	DLF-Jenks						71						–
Ambrosia	Pennington Seed		90										–
Athos	DLF-Jenks						93				60		77(2)
Benchmark	FFR/Sou. States	100	105	115	94	118	123	114				133	113(8)
Benchmark Plus	FFR/Sou. States							120			152	133	135(3)
Boone	Public			131		102							117(2)
Cheyenne	Western Prod. Inc.			94									–
Command	Seed Research of OR									81			–
Crown	Donley Seed		86	96									91(2)
Crown Royale	Donley Seed						100						–
Crown Royale Plus	Donley Seed							124				83	104(2)
Hallmark	James VanLeeuwen	107		104	103		115		113			83	104(6)
Haymate	FFR/Sou. States	93	71	102	96	53	115	100	118			83	92(9)
Intensiv	Barenbrug USA								51				–
Mammoth	DLF-Jenks						115						–
Megabite	Turf Seed						77						–
Niva	DLF-Jenks							76				83	80(2)
Persist	Smith Seed										138		–
Pizza	Advanta Seeds			63									–
Potomac	Public	98						116		119		117	113(4)
Prairie	Turner Seed					127	121					83	110(3)
Profile	Scott Seed	98						116					107(2)
Progress	Scott Seed	111											–
Tekapo	Ampac Seed	93	166	92	104		55	74	118		50	100	94(9)
Takena	Smith Seed		81				99						90(2)
WP300	Western Prod. Inc.			94									–

[1] Year trial was established.
[2] Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in stand persistence between varieties. To find actual persistence ratings, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in 1997 was grazed 4 years so the final report would be "2001 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage website at <www.uky.edu/Ag/Forage>.
[3] Mean only presented when respective variety was included in two or more trials.
[4] Number of years of data.
Stand thinning may have been greater for preferred varieties due to closer grazing. See individual trial tables for preference ratings.

Table 17. Summary of 2000-2009 Kentucky Perennial Ryegrass Grazing Tolerance Trials (stand persistence shown as a percent of the mean of the commercial varieties in the trial).

Variety	Proprietor	2000[1,2] 4yr[4]	2001 3yr	2003 4yr	2005 3-yr	Mean[3] (#trials)
AGRLP103	AgResearch USA	133		86		110(2)
Aries	Ampac Seed		139			–
BG 34	Barenbrug USA				176[5]	–
Citadel	Donley Seed	112				–
Granddaddy	Smith Seed Services		121			–
Lasso	DLF-Jenks		130			–
Linn	Public	117	129	63		103(3)
Maverick	Ampac Seed		36			–
Polly II	FFR/Southern States	37	68			53(2)
Quartet	Ampac Seed		77		63	70(2)
Remington	Barenbrug USA			1515		–
Tonga	Kings AgriSeeds				61	–

[1] Year trial was established.
[2] Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in stand persistence between varieties. To find actual persistence ratings, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in 2000 was grazed 4 years so the final report would be "2004 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage website at <www.uky.edu/Ag/Forage>.
[3] Mean only presented when respective variety was included in two or more trials.
[4] Number of years of data.
[5] Grazing tolerance values for these entries may have been elevated due to the low survival of the other commercial varieties in the trials for these years.

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