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2013 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 16, 17, and 18 show the summaries of all tall fescue, orchardgrass, and perennial ryegrass varieties tested in Kentucky during the past 15 years. 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.

Important Selection Considerations

Local adaptation and seasonal yield. The variety should be adapted to Kentucky as indicated by good winter survival and good performance across years and locations in replicated yield and grazing trials, such as those presented in this publication. Choose high-yielding, persistent varieties and varieties that are productive during the desired season of use. Refer to the appropriate yield trial reports for yield data on specific varieties of interest.

Seed quality. Buy premium-quality seed that is high in germination, high in purity, and free from weed seed. Buy certified seed or proprietary seed of an improved variety. An improved variety is one that has performed well in independent trials. Other information on the label will include the test date (which must be within the previous nine months), the level of germination, and percentage of other crop and weed seed. Order seed well in advance of planting time to assure that it will be available when needed.

Description of the Tests

Grass variety tests for grazing tolerance were established in Lexington in the fall of 2009, 2010, 2011 and 2012. 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 feet 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 steers or heifers and kept at 2 to 4 inches for the remainder of the grazing season. The trials were rated for grazing preference 10 to 20 days after cattle were allowed to start grazing (a rating of 1 indicates no forage removed and a rating of 9 indicates all forage was grazed). Individual trials occasionally were clipped to remove seedheads or weed growth not controlled by herbicides. Supplemental hay or soy-

Table 1. Temperature and rainfall at Lexington, Kentucky in 2010, 2011, 2012, and 2013.

	2010				2011				2012				2013[2]			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	29	-2	2.40	-0.46	29	-2	2.10	-0.76	38	+7	4.80	+1.94	38	+7	4.50	+1.64
FEB	29	-6	1.38	-1.83	39	+4	6.34	+3.13	40	+5	5.39	+2.18	36	+1	1.78	-1.43
MAR	47	+3	1.05	-3.35	47	+3	4.76	+0.36	56	+12	5.64	+1.24	39	-5	5.47	+1.07
APR	59	+4	2.74	-1.14	58	+3	12.36	+8.48	56	+1	3.26	-0.62	55	0	4.46	+0.58
MAY	67	+3	7.84	+3.37	64	0	6.72	+2.25	69	+5	4.02	-0.45	65	+1	5.23	+.076
JUN	76	+4	4.61	+0.95	74	+2	2.61	-1.05	73	+1	2.42	-1.24	72	0	7.32	+3.66
JUL	78	+2	5.49	+0.49	80	+4	6.29	1.29	81	+5	2.50	-2.50	72	-4	9.33	+4.33
AUG	78	+3	1.54	-2.39	75	0	2.89	-1.04	75	0	1.68	-2.25	72	-3	3.68	-0.25
SEP	71	+3	1.14	-2.06	66	-2	5.52	+2.32	67	-1	6.40	+3.20	67	-1	2.21	-0.99
OCT	59	+2	1.22	-1.35	55	-2	4.10	+1.53	55	-2	2.00	-0.57	55	-2	8.10	+5.53
NOV	47	+2	4.58	+1.19	50	+5	9.53	+6.14	43	-2	1.81	-0.65				
DEC	28	-8	2.15	-1.93	41	+5	5.58	+1.60	42	+6	9.57	+4.94				
Total			36.14	-8.41			68.80	+24.25			49.49	+4.94			52.08	+14.90

[1] DEP is departure from the long-term average.
[2] 2013 data is for the ten months through October.

Table 2. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 3, 2009 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 12, 2009	Grazing Preference[2] 2010 Apr 28	2011 May 2	2012 May 2	2013 May 20	Percent Stand 2009 Oct 12	2010 Apr 7	2010 Nov 22	2011 Mar 16	2011 Oct 4	2012 Mar 23	2012 Oct 13	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use														
KY31+[3]	4.3	6.7	4.5	1.8	1.3	100	100	100	100	100	100	99	99	99*
Jesup MaxQ	2.8	3.3	2.8	1.5	1.0	96	98	100	99	99	99	99	99	98*
Bronson	3.5	3.0	1.8	1.0	1.2	99	99	99	100	100	100	97	97	97*
Select	2.8	4.7	2.2	1.2	1.0	97	98	100	99	99	99	97	96	96
Experimental Varieties														
AgR 1521	2.3	5.0	3.0	1.5	1.0	95	99	100	100	100	100	99	100	99*
KY31-[3]	3.7	5.8	2.7	2.2	1.0	100	99	100	100	100	100	98	98	98*
GA-29	3.7	3.7	1.7	1.3	1.2	99	99	100	100	99	99	98	98	98*
KYFA0701	4.3	4.7	3.5	1.5	1.2	100	99	99	99	99	100	98	97	97*
AgR 1502	2.7	6.3	3.5	1.2	1.3	99	99	99	100	100	99	98	97	97*
TF 0202	3.3	7.1	4.0	3.7	1.3	98	97	98	99	98	98	94	94	95
Mean	3.4	5.0	3.0	1.7	1.2	98	99	100	100	99	99	98	97	98
CV,%	19.7	38.7	43.3	34.3	35.6	2	1	1	1	1	1	2	2	2
LSD,0.05	0.8	2.3	1.5	0.7	0.5	2	1	1	1	1	1	3	3	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: 2010-10 days, 2011-14 days, 2012-29 days, 2013-28 days.
[3] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ, AgR1502 and AgR1521 contain a non-toxic endophyte. The other fescue varieties in this test do not contain an endophyte.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

bean 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 30 pounds of actual N per acre in March, 30 pounds of actual N in May and 40 pounds of actual N in November. Other fertilizers (lime, P, and K) were applied as needed according to the University of Kentucky soil test recommendations.

Table 3. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 1, 2010 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 14, 2010	Grazing Preference[2] 2011 Apr 25	2012 May 2	2013 May 8	Percent Stand 2010 Oct 14	2011 Mar 15	2011 Oct 4	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use											
KY 31+[3]	3.3	5.8	1.2	1.2	99	99	99	98	99	99	99*
Select	3.4	3.5	1.5	1.0	99	99	99	99	97	97	99*
Jesup EF	3.1	2.3	1.0	1.0	99	100	99	99	99	99	99*
Jesup MaxQ	1.6	3.7	1.5	1.0	96	98	98	98	98	98	98*
Bronson	3.9	2.8	1.3	1.5	99	100	99	99	98	97	98*
Goliath	3.5	2.8	1.3	1.2	99	100	98	99	97	97	97*
BarOptima PlusE34	2.2	6.5	1.8	2.5	95	97	98	97	97	96	97
Cajun II	3.6	3.2	1.0	1.0	99	99	99	99	97	97	97
Experimental Varieties											
KY 31-[3]	3.8	4.7	1.2	1.2	99	99	99	99	99	99	98*
TF 0202	2.9	6.5	1.5	2.0	98	99	99	98	99	99	98*
AgR 1521	2.6	4.2	1.0	1.3	98	99	99	99	99	98	98*
KYFA0601	3.7	4.0	1.7	1.2	99	99	99	99	98	97	97*
KYFA0701	3.5	4.3	1.3	1.5	98	99	99	98	98	97	97*
GA29	2.5	2.8	1.7	1.2	97	98	98	97	97	97	97
AgR 1502	3.1	4.7	2.0	1.0	99	99	99	98	97	96	96
KYFA0901	2.6	4.8	1.2	1.3	96	96	96	95	96	96	96
Mean	3.1	4.2	1.4	1.3	98	99	98	98	98	97	97
CV,%	25.5	25.3	55.2	37.4	2	2	2	2	2	2	2
LSD,0.05	0.9	1.2	0.9	0.6	3	2	2	2	2	2	2

[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: 2011-7 days, 2012-29 days, 2013-16 days.
[3] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ, AgR 1502 and AgR 1521 contain a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this test do not contain an endophyte.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Results and Discussion

Weather data for Lexington are presented in Table 1. Data on percent stand are presented in tables 2 through 12. Statistical analyses were performed on all entries (including experimentals) to determine if the apparent 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.

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 13 (fescue), Table 14 (orchardgrass), and Table 15 (perennial ryegrass and festulolium) summarize 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 that 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.

Table 4. Seedling vigor, grazing preference and stand persistence of tall fescue varieties sown September 13, 2011 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 11, 2011	Grazing Preference[2] 2012 May 2	Grazing Preference[2] 2013 May 20	Percent Stand 2011 Oct 11	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use								
BarOptima PlusE34	4.4	3.3	3.5	100	100	100	100	100*
HyMark	4.8	1.5	1.3	100	100	100	100	100*
Jesup EF	4.9	2.2	1.3	100	100	100	100	100*
Jesup MaxQ	4.5	2.6	1.0	100	100	100	100	100*
KY31+[3]	4.7	4.3	1.7	100	100	100	100	100*
Select	4.4	2.0	1.2	100	100	100	100	100*
Experimental Varieties								
AGRFA 148	4.7	2.8	1.0	100	100	100	100	100*
KY31-[3]	4.7	4.7	1.3	100	100	100	100	100*
KYFA0804	4.9	1.0	1.2	100	100	100	100	100*
KYFA0902	4.8	3.0	2.8	100	100	100	100	100*
KYFA0905	4.8	4.3	3.0	100	100	100	100	100*
NFTF 1411	4.8	2.7	1.0	100	100	100	100	100*
Mean	4.7	2.9	1.7	100	100	100	100	100
CV,%	5.8	28.3	52.5	0	0	0	0	0
LSD,0.05	0.3	0.9	1.0	0	0	0	0	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: 2012-7 days, 2013-28 days.
[3] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ contains a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this test do not contain an endophyte.
*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 August 30, 2012 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 8, 2012	Grazing Preference[2] May 8, 2013	Percent Stand 2012 Oct 8	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use					
KY31+[3]	3.1	2.3	97	100	100*
BarOptima PlusE34	3.9	3.5	100	99	100*
Cowgirl	4.0	2.8	99	100	100*
Jesup EF	2.7	1.0	98	100	100*
Jesup MaxQ	3.2	1.2	99	99	100*
Select	3.3	1.2	98	99	99*
Flourish	3.6	4.5	98	98	99
Experimental Varieties					
KY31-[3]	3.7	2.0	100	100	100*
KYFA0901	3.3	2.8	98	99	100*
KYFA0905	3.3	3.3	99	99	99*
KYFA0906	3.0	2.5	98	99	99*
PPG-FTF 104	2.9	2.3	98	99	99
Mean	3.3	2.5	99	99	99
CV,%	33.8	42.5	2	1	1
LSD,0.05	1.3	1.2	3	2	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: 16 days.
[3] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ contains a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this test do not contain an endophyte.
*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 3, 2009, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oco 12, 2009	Grazing Preference[2] 2010 Apr 20	2011 May 2	2012 May 2	2013 May 20	Percent Stand 2009 Oct 12	2010 Apr 7	2010 Nov 22	2011 Mar 16	2011 Nov 7	2012 Mar 23	2012 Oct 13	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use														
BenchmarkPlus	4.2	7.3	5.8	1.5	2.8	91	96	94	94	83	85	89	91	88*
Persist	2.7	7.5	4.8	1.0	3.0	85	95	95	95	77	82	87	90	85*
Profit	2.7	7.7	5.8	1.3	1.8	87	94	90	93	74	82	83	89	79
Tekapo	2.0	8.8	6.0	1.7	3.0	79	85	86	89	68	71	85	88	79
Mean	2.9	7.8	5.6	1.4	2.7	86	92	91	93	75	80	86	89	83
CV,%	29.3	9.1	22.1	34.1	82.6	7	5	7	4	23	17	8	6	8
LSD,0.05	1.0	0.9	1.5	0.6	2.7	8	6	8	5	21	17	8	7	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: 2010-10 days, 2011-14 days, 2012-29 days, 2013-28 days.
*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 1, 2010, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 12, 2010	Grazing Preference[2] 2011 Apr 25	2012 May 2	2013 May 8	Percent Stand 2010 Oct 14	2011 Mar 15	2011 Oct 4	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 15
Commercial Varieties—Available for Farm Use											
BenchmarkPlus	3.7	6.2	1.0	1.3	100	98	97	98	98	98	97*
Tekapo	3.0	6.2	1.3	3.7	100	100	97	98	99	99	97*
Persist	1.2	7.5	1.2	1.0	91	93	92	93	95	95	95*
Profit	3.7	6.0	1.7	2.2	100	100	98	98	98	98	95*
Harvestar	2.8	7.7	2.0	3.7	99	100	96	97	98	98	90
Experimental Varieties											
OG 0503	3.0	6.7	1.3	1.2	99	99	99	99	99	99	97*
OG 9902	4.5	5.5	1.3	1.0	100	100	98	98	99	99	96*
Mean	3.1	6.5	1.4	2.0	98	99	97	97	98	98	95
CV,%	20.5	20.5	44.6	27.1	2	3	2	2	2	2	3
LSD,0.05	0.8	1.6	0.7	0.6	3	4	3	2	2	2	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: 2011-7 days, 2012-29 days, 2013-16 days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 8. Seedling vigor, grazing preference, and stand persistence of orchardgrass varieties sown September 13, 2011, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 11, 2011	Grazing Preference[2] 2012 May 2	2013 May 8	Percent Stand 2011 Oct 11	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use								
Tekapo	4.9	1.8	4.8	100	100	100	100	99*
Benchmark Plus	5.0	1.2	1.2	100	100	100	100	99*
Prairie	4.8	1.5	1.8	100	100	100	100	99*
Persist	4.9	1.8	1.2	100	100	100	100	98*
Profit	5.0	1.3	3.3	100	100	100	100	98*
Harvestar	4.8	1.5	6.2	100	100	100	100	97
Meran	4.9	1.5	3.1	100	100	100	100	98
CV,%	3.5	48.4	35.5	0	0	0	0	2
LSD,0.05	0.2	0.9	1.3	0	0	0	0	2

[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: 2012-29 days, 2013-16 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 of orchardgrass varieties sown August 30, 2012, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 8, 2012	Grazing Preference[2] May 8, 2013	Percent Stand 2012 Oct 8	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use					
Elise	3.4	3.7	99	100	100*
Benchmark Plus	4.5	2.0	99	99	99*
Tekapo	3.3	4.0	100	100	99*
Profit	4.3	1.8	100	100	99*
Persist	3.8	1.8	99	99	99*
Experimental Varieties					
PPG-OG106	2.7	4.2	98	99	99*
Mean	3.7	2.9	99	99	99
CV,%	14.4	19.7	1	1	1
LSD,0.05	0.6	0.7	2	1	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: 16 days.
*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 August 30, 2012, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 8, 2012	Grazing Preference[2] Apr 30, 2013	Percent Stand 2012 Oct 8	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use					
Linn	4.2	3.2	99	100	100*
BG34	3.8	4.0	99	100	99*
Calibra	4.5	3.7	100	100	99*
Duo (FL)	4.5	4.7	100	100	99*
Granddaddy	4.1	4.3	100	100	99*
Spring Green (FL)	4.1	4.3	100	100	99*
Boost	4.4	3.8	100	100	98*
Power	4.3	4.3	100	100	98*
TetraGain	3.4	5.0	98	99	98*
Meadow Green(FL)	5.0	6.7	100	85	2
Mean	4.2	4.4	100	98	89
CV,%	13.2	26.9	1	3	2
LSD,0.05	0.6	1.4	1	3	2

[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.

Tables 16, 17, and 18 are summaries of stand persistence data from 1996 to 2013 of commercial tall fescue, orchardgrass, and perennial ryegrass varieties that have been entered in the Kentucky trials. In Table 16 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 17 and 18 the data are listed as a percentage of the mean of the commercial varieties entered in each specific trial. In other words, the mean for 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 16, 17, and 18, but these comparisons do help 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 footnotes in tables 16, 17, and 18 to determine to which yearly report to refer.

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

Table 11. Seedling vigor, grazing preference and stand persistence of perennial ryegrass and festulolium (FL) varieties sown September 1, 2010, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 14, 2010	Grazing Preference[2] 2011 Apr 25	2012 May 2	2013 May 8	Percent Stand 2010 Oct 14	2011 Mar 15	2011 Oct 4	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 29
Commercial Varieties—Available for Farm Use											
BG34	4.2	7.7	1.2	3.5	100	100	100	100	86	86	85*
Spring Green (FL)	3.7	5.7	2.5	3.7	100	100	100	100	87	87	84*
Linn	3.7	4.5	1.2	1.7	100	100	100	100	91	91	82*
Barfest (FL)	4.0	6.7	2.2	3.5	100	100	99	99	90	91	78*
Power	3.7	7.5	2.5	2.8	100	100	99	99	93	92	78*
Granddaddy	3.7	6.3	1.7	2.2	100	100	100	100	86	86	75
Boost	4.3	4.8	2.2	4.2	100	99	99	100	79	81	70
Duo (FL)	5.0	4.0	3.0	2.8	100	99	88	93	72	72	63
Mean	4.0	5.9	2.0	3.0	100	100	98	99	85	86	77
CV,%	12.7	19.6	28.4	34.7	0	1	1	2	6	6	9
LSD,0.05	0.6	1.4	0.7	1.2	0	1	1	2	6	6	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: 2011-7 days, 2012-29 days, 2013-16 days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

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 avoid overgrazing it during times of extreme stress, such as drought.

About the Authors

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Table 12. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass and festulolium (FL) varieties sown September 13, 2011, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 11, 2011	Grazing Preference[2] 2012 May 2	Grazing Preference[2] 2013 May 8	Percent Stand 2011 Oct 11	2012 Mar 23	2012 Oct 10	2013 Mar 21	2013 Oct 14
Commercial Varieties—Available for Farm Use								
Linn	3.8	1.3	1.8	100	100	99	99	98*
BG34	4.0	1.3	3.7	100	100	98	99	98*
Spring Green (FL)	4.1	2.7	4.3	100	100	98	99	97*
Power	4.1	2.7	4.0	100	100	99	100	97*
Barfest (FL)	4.0	3.3	4.5	100	100	98	99	97*
Granddaddy	3.9	2.3	3.3	100	100	98	99	96*
Boost	4.1	3.2	3.7	100	100	98	98	96*
Duo (FL)	5.0	3.2	3.5	100	100	91	92	85
Experimental Varieties								
KYFA1016 (FL)	4.2	2.8	3.7	100	100	98	98	97*
KYFA1015 (FL)	3.9	3.7	4.5	100	100	99	99	97*
Mean	4.1	2.7	3.7	100	100	98	98	96
CV,%	5.1	30.9	28.4	0	0	2	2	3
LSD,0.05	0.2	1.0	1.2	0	0	2	2	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: 2012-29 days, 2013-16 days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 13. Summary of persistence of tall fescue varieties under heavy grazing pressure across years at Lexington, Kentucky.[1]

Variety	Proprietor/ KY distributor	2009[2] Apr 2010[3]	Nov	Mar 2011	Oct	Mar 2012	Oct	Mar 2013	Oct	2010 Mar 1011	Oct	Mar 2012	Oct	Mar 2013	Oct	2011 Mar 2012	Oct	Mar 2013	Oct	2012 Mar 2013	Oct
Commercial Varieties—Available for Farm Use																					
BarOptima PLUS E34	Barenbrug USA									x[5]	*	*	x	x	x	*	*	*	*	*	*
Bronson	Ampac Seed	*	*	*	*	*	*	*	*	*	*	*	*	*	*						
Cajun II	Smith Seed Services									*	*	*	x	*	x						
Cowgirl	Pure Seed																			*	*
Flourish	Allied Seed																			*	x
Goliath	Ampac Seed									*	*	*	x	*	*						
HyMark	Fraser Seeds															*	*	*	*		
Jesup EF	Pennington Seed									*	*	*	*	*	*	*	*	*	*	*	*
Jesup Max Q	Pennington Seed	x	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
KY 31+[4]	KY Agric. Exp. Station	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Select	FFR/Southern States	x	*	*	*	*	*	x	x	*	*	*	*	*	*	*	*	*	*	*	*
Experimental Varieties																					
AgR 1502	AgResearch (USA)	*	*	*	*	*	*	*	*	*	*	*	x	x	x						
AgR 1521	AgResearch (USA)	*	*	*	*	*	*	*	*	*	*	*	*	*	*						
AGRFA 148	AgResearch (USA)															*	*	*	*		
GA-29	Univ. of Georgia	*	*	*	*	*	*	*	*	*	*	*	*	*	x						
KY 31-[4]	KY Agric. Exp. Station	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
KYFA0601	KY Agric. Exp. Station									*	*	*	*	*	*						
KYFA0701	KY Agric. Exp. Station	*	*	*	*	*	*	*	*	*	*	*	*	*	*						
KYFA0804	KY Agric. Exp. Station															*	*	*	*		
KYFA0901	KY Agric. Exp. Station									x	*	x	x	x	x					*	*
KYFA0902	KY Agric. Exp. Station															*	*	*	*		
KYFA0905	KY Agric. Exp. Station															*	*	*	*	*	*
KYFA0906	KY Agric. Exp. Station																			*	*
NFTF 1411	Noble Foundation															*	*	*	*		
PPG-FTF 104	Mountain View Seeds																			*	x
TF0202	Allied Seed	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] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ, AgR1502 and AgR1521 contain a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this table do not contain an endophyte.
[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 14. Summary of persistence of orchardgrass varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety	Proprietor/KY distributor	2009[1]								2010						2011				2012	
		Apr	Nov	Mar	Nov	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct
		2010[2]		2011		2012		2013		2011		2012		2013		2012		2013		2013	
Commercial Varieties—Available for Farm Use																					
Benchmark Plus	FFR/Southern States	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Elise	Pure Seed																			*	*
Harvestar	Columbia Seeds									*	*	*	*	*	x	*	*	*	x		
Persist	Smith Seed Services	*	*	*	*	*	*	*	*	x[3]	x	x	x	x	*	*	*	*	*	*	*
Prairie	Turner Seed															*	*	*	*		
Profit	Ampac Seed Co.	*	*	*	*	*	*	*	x	*	*	*	*	*	*	*	*	*	*	*	*
Tekapo	Ampac Seed Co.	x	x	x	*	*	*	*	x	*	*	*	*	*	*	*	*	*	*	*	*
Experimental Varieties																					
OG 0503	FFR/Southern States									*	*	*	*	*	*						
OG 9902	FFR/Southern States									*	*	*	*	*	*						
PPG-OG 106	Mountain View Seeds																			*	*

[1] Establishment year.
[2] Date of visual rating of percent stand.
[3] "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 15. Summary of persistence of perennial ryegrass and festulolium (FL) varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety	Proprietor/KY Distributor	2010[1]						2011				2012	
		Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct	Mar	Oct
		2011[2]		2012		2013		2012		2013		2013	
Commercial Varieties—Available for Farm Use													
Barfest (FL)	Barenbrug USA	*	*	*	*	*	*	*	*	*	*		
BG34	Barenbrug USA	*	*	*	x[3]	*	*	*	*	*	*	*	*
Boost	Allied Seed	*	*	*	x	x	x	*	*	*	*	*	*
Calibra	DLF International											*	*
Duo (FL)	Ampac Seed Co.	*	x	x	x	x	x	*	*	x	x	*	*
Granddaddy	Smith Seed	*	*	*	*	*	x	*	*	*	*	*	*
Linn	Public	*	*	*	*	*	*	*	x	*	*	*	*
Meadow Green (FL)	Pure Seed											x	x
Power	Ampac Seed Co.	*	*	*	*	*	*	*	*	*	*	*	*
SpringGreen (FL)	Rose Agri-Seed	*	*	*	*	*	*	*	*	*	*	*	*
Tetra Gain	Pure Seed											*	*
Experimental Varieties													
KYFA1015 (FL)	KY Agric.Exp. Station							*	*	*	*		
KYFA1016 (FL)	KY Agric.Exp. Station							*	*	*	*		

[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 16. Summary of 1996-2013 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	2007	2008	2009	2010	2002	Mean[3]
Variety	Proprietor	3yr[4]	4yr	3yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	4yr	*(#trials)*
Advance MaxQ	Pennington Seed											94						–
Bariane	Barenbrug USA								89		75	47	29					60(4)
Barcel	Barenbrug USA	92																–
BarElite	Barenbrug USA												96					–
Barolex	Barenbrug USA										78	101	86					88(3)
BarOptima PLUS E34	Barenbrug USA										100		97			98		98(3)
BAR9TMPO	Barenbrug USA				75													–
Bronson	Ampac Seed			39											98	99		79(3)
Cajun II	Smith Seed Services															98		–
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														–
Goliath	Ampac Seed															98		–
Hoedown	DLF-Jenks					88												–
HyMark	Fraser Seeds													95				–
Jesup EF	Pennington Seed		63	91					99							100		88(4)
Jesup MaxQ	Pennington Seed			114	79			103	97		68	102	97	97	99	99	105	96(11)
Johnstone	Proseeds		65	107			92											88(3)
KY31+[5]	KY Agri. Exp Sta.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100(16)
KY31-[5]	KY Agri. Exp Sta.	94	90	102	84		98	103	98	100	82	100	100	98	99	99	105	97(15)
Kenhy	Public			116														–
Kokanee	Ampac Seed					43												–
Martin II	International Seeds		59															–
Maximize	Rose Agri-Seed						99											–
Nanryo	Japanese Grassland For. Seed/ USDA-ARS,ElReno,OK												100					–
Orygun	–							99										–
Resolute	Ampac Seed						23											–
Select	FFR/Sou. St.			109	69	107	101	100	100		67	100	93	95	97	100	98	95(13)
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											100						–
Verdant	Am.Grass Seed											97						–
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 1997 was grazed four years so the final report would be "2001 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage Web site 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] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ and Advance MaxQ contain a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this table do not contain an endophyte.

Table 17. Summary of 1996-2013 Kentucky orchardgrass grazing tolerance trials (stand persistence shown as a percent of the mean of the commercial varieties in the trial).

		Lexington												Princeton	Mean[3]
		1996[1,2]	1997	1998	1999	2000	2001	2002	2003	2004	2005	2007	2009	2010	2002	
Variety	Proprietor	3yr[4]	4yr	3yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	4yr	*(#trials)*
Abertop	Pennington Seed							38								–
Albert	Univ. of Wisconsin						115									–
Amba	DLF-Jenks						71									–
Ambrosia	Pennington Seed		90									94				92(2)
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	135	106	102	133	124(6)
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)
Harvestar	Columbia Seeds											75		95		85(2)
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	107	103	100		112(4)
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)
Profit	Ampac Seed												95	100		98(2)
Progress	Scott Seed	111														–
Tekapo	Ampac Seed	93	166	92	104		55	74	118		50	103	95	102	100	96(12)
Takena	Smith Seed		81				99									90(2)
Seco	FFR/Sou. States											85				–
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 four years so the final report would be "2001 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage Web site 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 18. Summary of 2000-2013 Kentucky perennial ryegrass and festulolium (FL) grazing tolerance trials in Lexington (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 3yr	2007 4yr	2008 4yr	2010 3yr	Mean[3] *(#trials)*
AGRLP103	AgResearch USA	128		86					107(2)
Aries	Ampac Seed		139						–
Barfest (FL)	Barenbrug USA							101	–
BG 34	Barenbrug USA				176[5]	145[5]		111	144(3)
Boost	Allied Seed						101	91	96(2)
Citadel	Donley Seed	107							–
Duo (FL)	Ampac Seed	116					95	82	98(3)
Granddaddy	Smith Seed Services		121			70		98	96(3)
Lasso	DLF-Jenks		130						–
Linn	Public	112	129	63			95	107	101(5)
Maverick	Ampac Seed		36						–
Polly II	FFR/Southern States	36	68						52(2)
Power	Ampac Seed					134		101	118(2)
Quartet	Ampac Seed		77		63	50			60(3)
Remington	Barenbrug USA			151[5]					–
Spring Green (FL)	Rose Agri-Seed	101					109	109	106(3)
Tonga	Ampac Seed				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 four years so the final report would be "2004 Cool-Season Grass Grazing Tolerance Report" archived in the KY Forage Web site 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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