



2019 Cool-Season Grass Grazing Tolerance Report

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Introduction

Cool-season grasses such as tall fescue, orchardgrass, and Kentucky bluegrass are the primary pasture grasses in Kentucky. Other species such as perennial ryegrass, festulolium, and the bromegrasses 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. This is not our recommendation on-farm, but indicates which varieties will survive a worst case scenario that often occurs over the life of a typical pasture. The main focus will be on plant stand survival. Tables 17, 18, and 19 show the summaries of all tall fescue, orchardgrass, and perennial ryegrass varieties tested in Kentucky during the past 15 years. The UK Forage Extension website, at forages.ca.uky.edu, 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 and 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), 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 2015, 2016, 2017, and 2018. The soil at Lexington (Maury) is a well-drained silt loam and is well-suited to tall fescue, orchardgrass, and perennial 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 was 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

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2016, 2017, 2018, and 2019

	2016				2017				2018				2019 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	32	+1	0.80	-2.06	40	+9	6.81	+3.95	31	0	2.01	-0.85	33	+2	4.11	+1.25
FEB	38	+3	6.09	+2.88	47	+12	4.46	+1.25	45	+10	9.77	+6.56	42	+7	7.64	+4.43
MAR	52	+8	4.07	-0.33	48	+4	3.34	-1.06	42	-2	5.16	+0.76	43	-1	3.44	-0.91
APR	57	+2	3.97	+0.09	62	+7	4.17	+0.29	50	-5	5.52	+1.64	54	+4	4.76	+0.88
MAY	64	0	9.17	+4.70	66	+2	7.74	+3.27	73	+9	8.39	+3.92	69	+5	4.49	+0.02
JUN	76	+4	5.09	+1.43	73	+1	7.68	+4.02	76	+4	6.42	+2.76	73	+1	6.13	+2.47
JUL	79	+3	7.43	+2.43	76	0	4.49	-0.51	77	+1	6.15	+1.15	79	+3	3.30	-1.70
AUG	79	+4	4.37	+0.44	74	-1	6.66	+2.73	77	+2	6.45	+2.52	77	+2	2.42	-1.51
SEP	74	+6	2.18	-1.02	69	+1	4.72	+1.52	74	+6	12.88	+9.68	77	+9	0.18	-3.02
OCT	64	+7	0.37	-2.20	60	+3	6.06	+3.49	59	+2	6.54	+3.97	61	+4	8.15	+5.58
NOV	51	+6	1.94	-1.45	47	+2	3.09	-0.30	42	-3	5.64	+2.25				
DEC	37	+1	9.4	+5.42	35	-1	2.66	-1.32	40	+4	7.35	+3.37				
Total			54.88	+10.33			61.88	+17.33			82.28	+37.73			44.67	+7.49

¹ DEP is departure from the long-term average.

² 2019 data is for ten months through October.

Table 2. Seedling vigor, grazing preference, and stand persistence of tall fescue varieties sown September 3, 2015, in cattle grazing tolerance study at Lexington, Kentucky

Variety	Endophyte Status ¹	Seedling Vigor ² Oct 19, 2015	Grazing Preference ³			Percent Stand									
			2016	2017	2018	2015		2016		2017		2018		2019	
			Apr 26	Apr 26	May 18	Oct 19	Mar 24	Oct 4	Mar 22	Oct 12	Mar 15	Oct 16	Mar 28	Oct 18	
Commercial Varieties-Available for Farm Use															
Select	free	4.1	2.0	1.0	1.0	99	99	100	100	100	100	100	100	100	100*
BarOptima PLUS E34	novel	3.8	2.4	3.5	1.0	98	99	100	100	100	100	100	100	99	99*
Jesup MaxQ	novel	4.7	1.5	1.0	1.0	99	100	100	100	100	100	100	99	99	99*
Lacefield MaxQII	novel	4.6	2.3	1.8	1.0	99	100	100	100	100	100	100	100	99	99*
Cajun II	free	4.1	1.3	1.0	1.0	96	100	99	99	99	99	99	99	99	99*
KY31+	toxic	4.8	2.3	1.3	1.0	99	100	100	100	100	100	100	100	99	99*
SS-0705TFSL	free	4.5	1.4	1.0	1.0	99	100	100	100	100	100	100	100	99	99*
Dominate	free	4.4	2.0	1.2	1.0	98	100	97	98	97	97	97	98	98	98
Drover	free	4.4	1.0	1.0	1.0	98	99	99	99	99	99	99	99	98	98
Baguala	free	4.4	1.8	1.0	1.0	98	100	98	98	98	98	98	98	98	98
FSG402TF	free	4.3	1.8	1.0	1.0	98	99	99	99	99	99	99	99	99	98
Experimental Varieties															
KYFA1114	free	4.6	2.2	1.3	1.0	98	100	100	100	100	100	100	100	100	100*
KYFA1311	free	4.6	2.5	1.7	1.0	100	100	100	100	100	100	100	100	100	100*
KYFA9821/AR584	novel	4.8	1.8	1.3	1.0	99	100	100	100	100	100	100	100	100	100*
KYFA1113	free	4.8	2.2	1.7	1.0	100	100	100	100	100	100	100	100	100	99*
Drover+E34	novel	4.3	1.2	1.0	1.0	99	100	99	100	100	100	100	100	100	99*
KY31-	free	4.8	2.3	1.3	1.0	99	100	100	100	100	100	99	99	99	99*
BARFAF131	free	3.7	3.5	1.3	1.0	98	100	99	100	99	99	99	99	99	98
Mean		4.4	2.0	1.4	1.0	98	100	99	99	99	99	99	99	99	99
CV,%		8.8	31.7	35.3	0.0	2	1	1	1	1	1	1	1	1	1
LSD,0.05		0.4	0.7	0.6	0.0	3	1	1	1	1	1	1	1	1	1

¹ Free-varieties that do not contain an endophyte. Toxic-KY31+ contains a toxic endophyte. Novel-varieties that contain an endophyte that aids persistence but is not toxic to cattle.

² Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

³ Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating; 2016-20 days, 2017-14 days, 2018-18 days.

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

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.

Results and Discussion

Weather data for Lexington are presented in Table 1. Data on percent stand are presented in Tables 2 through 13. 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: Can endophyte-free varieties persist as well as KY31+, and 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, 3, and 17).

Tables 14 (tall fescue), 15 (orchardgrass), and 16 (perennial ryegrass and festulolium) show information about proprietors/distributors for all varieties in these tests. Varieties are listed in alphabetical order, with experimental varieties at the bottom.

Tables 17, 18, and 19 are summaries of stand persistence data from 2000 to 2019 of commercial tall fescue, orchardgrass, and perennial ryegrass varieties that have been entered in the Kentucky trials. In Table 17 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 18 and 19 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

Table 3. Seedling vigor, grazing preference, and stand persistence of tall fescue and meadow (MF) varieties sown September 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Endophyte Status ¹	Seedling Vigor ² Oct 5, 2016	Grazing Preference ³			Percent Stand						
			2017		2018	2016		2017		2018		2019
			Apr 26	Jun 2	May 18	Oct 5	Mar 15	Oct 11	Mar 16	Oct 16	Mar 28	Oct 18
Commercial Varieties-Available for Farm Use												
Bronson	free	3.8	1.5	1.8	1.0	100	100	100	100	100	100	100*
Bull	free	3.1	1.0	1.5	1.0	100	100	100	100	100	100	100*
Cajun II	free	3.5	1.2	1.7	1.0	98	99	99	100	100	100	100*
Goliath	free	3.7	1.5	2.7	1.0	100	100	100	100	100	100	100*
Jesup MaxQ	novel	4.5	1.8	3.0	1.0	100	100	100	100	100	100	100*
KY31+	toxic	3.6	2.7	4.0	1.0	100	100	100	100	100	100	100*
Lacefield MaxQII	novel	4.4	2.0	4.0	1.0	100	100	100	100	100	100	100*
SS0705TFSL	free	4.2	1.5	2.8	1.0	99	100	100	100	100	100	100*
BarOptima PLUS E34	novel	3.3	2.8	3.8	1.3	100	100	100	100	99	98	99*
Cosmonaut (MF)	free	3.6	5.2	7.8	5.0	99	99	99	100	84	75	8
Experimental Varieties												
KY31-	free	3.8	2.0	2.5	1.0	100	100	100	100	100	100	100*
KYFA1201	free	3.8	2.2	3.7	1.0	100	100	100	100	100	100	100*
KYFA1303	free	4.8	2.3	5.0	1.0	100	100	100	100	100	100	100*
KYFA9732/AR584	novel	4.1	2.5	3.8	1.0	100	100	100	100	100	100	100*
KYFA9304	free	4.5	2.7	4.5	1.0	100	100	100	100	99	99	100*
KYPP0901 (MF)	free	4.7	4.3	7.2	3.3	100	100	100	100	96	93	13
Mean		4.0	2.3	3.7	1.4	100	100	100	100	99	98	89
CV,%		14.0	25.7	37.0	26.4	1	1	1	0	5	6	3
LSSD,0.05		0.6	0.7	1.6	0.4	1	1	1	0	5	7	3

¹ Free-varieties that do not contain an endophyte. Toxic-KY31+ contains a toxic endophyte. Novel-varieties that contain an endophyte that aids persistence but is not toxic to cattle.

² Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

³ Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating; 2017-14 days, 2018-18 days.

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

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 17, 18, and 19, 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 17, 18, and 19 to determine which yearly report should be referenced.

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.

For further information about grazing management, refer to the College of Agriculture publications, available at the local Extension office or in the publications section of the UK Forage Extension website at forages.ca.uky.edu.

- Rotational Grazing (ID-143)
- Tall Fescue (AGR-59)
- Fescue Toxicosis (ID-221)
- Producers Guide to Pasture-Based Finishing (ID-224)
- Broadleaf Weeds of Kentucky Pastures (AGR-207)

About the Authors

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Table 4. Seedling vigor, grazing preference, and stand persistence of tall fescue varieties sown September 9, 2017, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Endophyte Status ¹	Seedling Vigor ² Oct 12, 2017	Grazing Preference ³ May 18, 2018	Percent Stand				
				2017	2018		2019	
				Oct 12	Mar 14	Oct 16	Mar 28	Oct 18
Commercial Varieties-Available for Farm Use								
Jesup MaxQ	novel	3.8	1.0	99	99	99	99	99*
KY31+	toxic	4.1	1.0	100	100	100	99	99*
SS0705TFSL	free	4.3	1.0	100	100	99	99	99*
Lacefield MaxQII	novel	4.2	1.0	100	100	99	98	98*
Cajun II	free	3.5	1.0	99	99	98	98	98*
Bull	free	3.3	1.0	98	99	99	97	97*
BarOptima PLUS E34	novel	4.1	1.2	100	100	98	97	96
Experimental Varieties								
KYFA1305	free	3.9	1.2	99	100	99	99	99*
KYFA9304	free	4.6	1.0	100	100	99	98	99*
KY31-	free	4.1	1.0	99	99	99	99	98*
KYFA1304	free	3.7	1.0	98	99	99	98	98*
KYFA1404	free	3.2	1.0	98	98	98	98	98*
KYFA1405	free	3.0	1.0	97	97	98	98	98*
KYFA1306	free	4.1	1.0	99	99	99	98	98*
STF50	free	2.7	1.0	96	97	97	97	97
BARFA6BTR179	free	3.6	2.2	100	100	93	93	93
Mean		3.8	1.1	99	99	98	98	98
CV,%		18.0	21.5	1	1	2	2	2
LSD,0.05		0.8	0.3	1	2	2	2	2

¹ Free-varieties that do not contain an endophyte. Toxic-KY31+ contains a toxic endophyte. Novel-varieties that contain an endophyte that aids persistence but is not toxic to cattle.

² Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

³ Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating: 2018-18 days.

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

Table 5. Seedling vigor and stand persistence of tall fescue varieties sown September 5, 2018, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Endophyte Status ¹	Seedling Vigor ² Sep 28	Percent Stand		
			2018	2019	
			Sep 28	Mar 28	Oct 18
Commercial Varieties-Available for Farm Use					
KY31+	toxic	2.8	90	93	93*
Lacefield MaxQII	novel	3.8	88	91	91*
SS0705TFSL	free	3.8	89	90	90*
Jesup MaxQ	novel	2.8	81	87	88*
Cajun II	free	3.4	83	87	86*
Bull	free	3.3	81	85	86*
BarOptima PLUS E34	novel	3.3	83	84	84
Experimental Varieties					
RADMR20	free	3.4	90	89	91*
KYFA9304	free	3.3	90	89	90*
KY31-	free	3.5	88	87	88*
7FAC82	free	3.6	88	89	88*
7016	free	3.7	87	87	88*
BARFAF137	free	3.1	82	85	88*
KYFA9611	free	2.9	84	85	86*
BARFAF135	free	2.8	82	82	83
KYFA9821/AR584	novel	3.0	82	83	83
BARFABTR7NEA23	novel	2.2	78	80	80
BARFA6BR-179	free	2.5	81	82	79
BARFAF131	free	2.0	70	79	79
KYFA1704	free	3.0	78	77	77

¹ Free-varieties that do not contain an endophyte. Toxic-KY31+ contains a toxic endophyte. Novel-varieties that contain an endophyte that aids persistence but is not toxic to cattle.

² Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

*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, 2015, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 19, 2015	Grazing Preference ²					Percent Stand								
		2016		2017		2018	2015	2016		2017		2018		2019	
		Apr 26	Apr 26	Jun 2	May 18	Oct 19	Mar 24	Oct 4	Mar 22	Oct 20	Mar 15	Nov 15	Mar 28	Nov 5	
Commercial Varieties-Available for Farm Use															
SS-0708OGDT	4.8	3.3	3.3	6.3	2.2	100	100	99	99	97	94	74	73	58*	
Potomac	5.0	3.0	3.7	6.8	1.7	100	100	99	99	98	97	57	55	48*	
Persist	4.6	3.3	3.3	6.8	1.3	100	100	99	99	98	96	63	58	46*	
Prairie	4.2	3.5	3.7	7.2	1.8	99	100	99	99	97	97	58	52	43*	
Profit	4.6	4.1	3.9	7.6	4.3	100	100	99	99	95	94	46	41	36	
Tekapo	4.5	7.0	5.0	8.0	4.7	100	96	97	98	95	93	47	36	34	
Experimental Varieties															
OG-0707	4.8	3.2	3.8	6.8	2.5	100	100	100	100	98	97	73	68	55*	
KYDG1002	4.3	5.0	4.8	7.2	4.3	100	100	99	98	97	93	48	44	38	
KYDG1001	3.8	4.7	4.8	8.0	3.8	100	100	98	98	97	96	43	42	32	
Dg82Ro1	3.4	4.2	4.6	7.4	4.8	99	100	97	98	94	94	42	36	28	
Mean	4.4	4.1	4.1	7.2	3.1	100	100	99	99	97	95	56	51	42	
CV,%	11.3	24.9	21.5	14.3	29.9	1	1	1	1	2	3	24	26	33	
LSD,0.05	0.6	1.2	1.0	1.2	1.1	1	1	2	1	2	3	16	16	16	

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; 2016-13 days, 2017-14 days, 2018-18 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 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 5, 2016	Grazing Preference ²			Percent Stand							
		2017		2018	2016	2017		2018		2019		
		Apr 26	Jun 2	May 18	Oct 5	Mar 15	Oct 11	Mar 16	Oct 31	Mar 28	Nov 5	
Commercial Varieties-Available for Farm Use												
Devour	3.4	4.8	8.3	6.3	100	100	100	100	92	92	85*	
Persist	4.1	3.2	6.8	1.2	100	100	100	100	82	83	74*	
Prairie	4.1	2.8	6.5	2.0	100	100	100	100	78	78	72*	
Potomac	4.2	2.8	7.0	1.7	100	100	100	100	76	78	70	
SS0708OGDT	4.8	3.0	7.3	2.3	100	100	100	100	76	77	69	
Prodigy	4.2	3.5	7.3	2.7	100	100	100	100	72	74	67	
Harvestar	3.7	4.3	8.3	6.7	100	100	100	100	63	64	55	
Elise	3.4	5.3	7.8	6.3	100	100	100	100	60	59	50	
Experimental Varieties												
KYDG1001	4.3	4.2	7.2	3.3	100	100	100	100	77	77	62	
KYDG1002	4.4	4.2	8.2	3.5	100	100	100	100	68	67	50	
Mean	4.1	3.8	7.5	3.6	100	100	100	100	74	75	65	
CV,%	12.4	22.1	14.3	26.5	0	0	0	0	16	15	18	
LSD,0.05	0.6	1.0	1.2	1.1	0	0	0	0	14	13	13	

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; 2017-14 days, 2018-18 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 9, 2017, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 12, 2017	Grazing Preference ² May 18, 2018	Percent Stand				
			2017	2018		2019	
			Oct 12	Mar 14	Oct 16	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use							
Potomac	3.7	2.7	98	99	96	95	73*
Persist	3.7	2.0	98	98	94	88	70*
SS0708OGDT	4.4	2.2	99	99	96	93	70*
Prodigy	4.3	2.5	100	100	95	91	67*
Prairie	3.4	3.2	97	99	93	87	64*
Experimental Varieties							
SOG-1614	2.6	7.3	92	93	91	85	58
Mean	3.7	3.3	97	98	94	90	67
CV,%	15.8	22.7	2	2	4	6	19
LSD,0.05	0.7	0.9	2	2	4	6	15

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: 2018-18 days.

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

Table 9. Seedling vigor and stand persistence of orchardgrass varieties sown September 5, 2018, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Sep 28, 2018	Percent Stand		
		2018	2019	
		Sep 28	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use				
Persist	4.3	96	96	96*
SS0708OGDT	4.7	97	97	96*
Prairie	4.7	95	96	95*
Prodigy	4.4	94	94	92*
Swante	1.8	73	79	68
Experimental Varieties				
DgLF48	3.7	92	92	91*
18-DgLF92	3.3	93	92	90*
18-DgLF93	2.8	88	85	86
Mean	3.8	92	92	90
CV,%	16.5	8	7	6
LSD,0.05	0.8	9	8	6

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

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

Table 10. Seedling vigor, grazing preference, winter injury, and stand persistence of perennial ryegrass and festulolium (FL) varieties sown September 3, 2015, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 19, 2015	Grazing Preference ²					Winter Injury ³ Jan 29, 2016	Percent Stand									
		2016		2017		2018		2019	2015	2016		2017		2018		2019	
		Apr 26	Apr 26	Jun 2	May 18	May 20		Oct 19	Mar 24	Oct 4	Mar 22	Oct 18	Mar 15	Oct 31	Mar 28	Oct 25	
Commercial Varieties-Available for Farm Use																	
Remington	4.4	1.7	3.2	7.2	5.7	4.8	0.9	100	100	100	100	99	99	97	96	93*	
Remington PLUS NEA2 ⁴	4.3	1.8	3.5	7.2	5.3	5.5	1.0	100	100	100	99	98	98	93	93	88*	
Albion	3.1	1.9	3.5	8.3	5.7	5.2	1.0	84	100	99	97	89	86	77	77	62	
Calibra	4.7	2.1	4.0	7.0	5.3	2.8	1.1	100	100	98	97	86	84	69	69	50	
SpringGreen (FL)	4.3	2.3	4.2	6.8	4.8	3.2	1.3	99	100	96	95	90	88	68	67	45	
BG-34	3.5	1.5	3.3	6.8	4.8	3.7	1.3	99	100	99	90	86	81	64	67	43	
Power	4.3	2.0	4.2	6.5	5.2	3.5	1.5	100	100	99	97	90	81	70	63	43	
Linn (certified)	3.8	1.8	3.0	2.3	2.0	1.0	2.7	100	100	97	96	84	80	50	48	38	
Duo (FL)	4.9	4.8	3.8	5.2	4.7	3.0	7.5	100	92	88	87	76	61	56	55	36	
Barvitra	5.0	3.5	4.7	6.2	5.0	2.3	2.3	100	100	62	42	35	23	23	22	18	
Experimental Varieties																	
BARLP15261	3.4	1.8	3.3	7.7	6.0	5.0	0.8	100	100	100	100	98	98	95	95	90*	
GPT-14021	3.7	2.2	3.7	7.7	5.7	5.0	0.8	100	100	100	100	98	96	91	90	83*	
GDP-14018	4.3	1.7	3.8	7.0	5.5	4.2	1.9	100	100	98	97	97	81	81	74	74	
GDP-14017	4.2	1.9	2.8	4.2	2.5	1.8	2.7	100	100	93	88	88	88	67	63	48	
TAL-PR-02	4.0	4.2	2.8	4.2	3.5	2.8	5.8	100	84	92	93	85	61	60	53	45	
GDP-14019	4.1	6.5	3.7	5.8	3.5	2.5	8.5	100	33	65	57	57	33	33	38	33	
KYFA9819 (FL)	4.0	2.2	3.8	5.3	3.8	2.3	0.9	99	100	98	92	70	57	42	42	32	
GPT-14023	4.2	6.2	3.5	5.3	3.3	2.0	7.8	100	34	62	69	64	35	39	37	30	
KYFL1013 (FL)	4.7	2.7	3.8	4.3	4.2	2.8	1.0	100	100	99	98	91	70	61	59	30	
TAL-PR-04	3.8	4.2	2.8	2.7	2.3	1.0	6.8	100	88	93	93	87	51	47	42	28	
TAL-PR-03	2.6	3.3	3.2	4.5	2.5	2.2	5.0	98	95	84	55	41	23	28	29	24	
Mean	4.0	2.8	3.5	5.8	4.2	3.2	2.9	99	92	92	88	82	72	63	60	49	
CV,%	12.4	25.5	24.4	25.0	18.0	30.6	20.1	3	10	10	11	13	21	23	26	26	
LSD,0.05	0.6	0.8	1.0	1.7	0.9	1.3	0.7	4	11	10	11	12	17	17	18	15	

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; 2016-13 days, 2017-14 days, 2018-18 days, 2019-30 days.

³ Winter injury based on a score of 1 to 9 with 9 being the greatest amount of injury.

⁴ Remington PLUS NEA2 contains a non-toxic (novel) endophyte.

*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 and festulolium (FL) varieties sown September 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 5, 2016	Grazing Preference ²				Percent Stand							
		2017		2018	2019	2016	2017		2018		2019		
		Apr 26	Jun 2	May 18	May 20	Oct 5	Mar 15	Oct 11	Mar 16	Oct 16	Mar 28	Oct 25	
Commercial Varieties-Available for Farm Use													
Remington	4.2	2.8	4.3	5.5	5.3	100	100	100	100	100	100	93*	
Calibra	4.8	4.0	5.2	4.8	3.3	100	100	100	100	97	96	74	
Melpetra	3.0	5.0	6.3	6.7	5.3	100	100	100	98	97	96	73	
Linn (certified)	4.1	2.5	2.0	3.2	1.0	100	100	100	100	75	79	66	
SpringGreen (FL)	3.7	3.3	3.8	5.2	3.2	100	100	100	100	88	88	61	
Duo (FL)	4.9	4.5	5.2	4.5	3.0	100	100	88	87	75	75	46	
Experimental Varieties													
BARLP16237	3.6	3.3	5.0	6.2	5.5	100	100	100	100	100	100	93*	
BARLP15261	4.0	3.5	5.0	6.2	5.3	100	100	100	100	100	99	89*	
BARLP15COW	4.4	2.3	2.8	4.5	2.5	100	100	100	98	97	96	87*	
BARLP16238	4.0	2.8	3.7	4.5	1.8	100	100	99	98	95	95	87*	
KYFL1301 (FL)	4.3	4.0	4.7	4.8	3.7	100	100	99	100	96	96	73	
Mean	4.1	3.5	4.4	5.1	3.7	100	100	99	98	93	93	76	
CV,%	11.1	24.6	30.4	13.7	15.7	0	0	2	2	9	8	15	
LSD,0.05	0.5	1.0	1.5	0.8	0.7	0	0	2	2	10	9	13	

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; 2017-14 days, 2018-18 days 2019-30 days.

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

Table 12. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass varieties sown September 9, 2017, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 12, 2017	Grazing Preference ²		Percent Stand				
		2018	2019	2017	2018		2019	
		May 18	May 20	Oct 12	Mar 14	Oct 16	Mar 28	Oct 18
Commercial Varieties-Available for Farm Use								
Remington	4.4	4.0	2.0	99	99	98	97	95*
Victorian	4.8	3.2	2.0	100	84	88	91	85*
PayDay	3.6	3.8	3.3	98	99	96	94	76
TetraGain	3.4	3.6	2.8	97	98	74	73	56
Linn (certified)	4.6	2.3	2.8	100	100	85	76	56
Experimental Varieties								
BARLP17237	3.3	4.5	2.2	97	98	99	98	96*
BARLM16238	4.6	3.3	2.2	100	100	90	88	68
BARLP17253	4.1	3.3	3.2	99	100	92	94	58
Mean	4.1	3.5	2.6	99	97	90	88	73
CV,%	10.4	20.0	55.0	1	6	12	12	21
LSD,0.05	0.5	0.9	1.8	1	6	13	12	18

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; 2018-18 days, 2019-30 days.

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

Table 13. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass varieties sown September 5, 2018, in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Sep 28, 2018	Grazing Preference ² May 20, 2019	Percent Stand		
			2018	2019	
			Sep 28	Mar 28	Oct 18
Commercial Varieties-Available for Farm Use					
Remington	4.8	3.7	100	100	100*
Remington PLUS NEA ³	4.4	3.7	98	98	99*
PayDay	4.3	3.2	100	99	98*
Calibra	4.4	3.0	100	100	97*
TetraSweet	4.8	3.0	100	99	97*
Linn	4.4	1.0	100	95	93
TetraMag	4.8	3.3	100	100	91
Experimental Varieties					
BARLPF253	4.0	2.5	100	99	97*
Mean	4.5	2.9	100	99	96
CV,%	10.3	18.9	1	2	3
LSD,0.05	0.5	0.6	1	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; 2019-30 days.

³ Remington PLUS NEA2 contains a non-toxic (novel) endophyte.

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

Table 14. Proprietors of tall fescue varieties in current grazing trials in Kentucky

Variety	Endophyte Status ¹	Proprietor/ KY distributor
Commercial Varieties-Available for Farm Use		
Baguala	free	Allied Seed
BarOptima PLUS E34	novel	Barenbrug USA
Bronson	free	Ampac Seed
Bull	free	Caudill Seed
Cajun II	free	Smith Seed Services
Dominate	free	Allied Seed
Drover	free	Barenbrug USA
FSG 402TF	free	Farm Service Genetics
Goliath	free	Ampac Seed
Jesup MaxQ	novel	Pennington Seed
KY 31+	toxic	KY Agric. Exp. Station
Lacefield MaxQ II	novel	Pennington Seed
Select	free	Southern States
SS-0705TFSL	free	Southern States
Experimental Varieties²		
BARFA6BTR179	free	Barenbrug USA
BARFABTR7NEA23	novel	Barenbrug USA
BARFAF131	free	Barenbrug USA
BARFAF135	free	Barenbrug USA
BARFAF137	free	Barenbrug USA
Drover/E34	novel	Barenbrug USA
KY 31-	free	KY Agric. Exp. Station
KYFA1113	free	KY Agric. Exp. Station
KYFA1114	free	KY Agric. Exp. Station
KYFA1201	free	KY Agric. Exp. Station
KYFA1311	free	KY Agric. Exp. Station
KYFA1303	free	KY Agric. Exp. Station
KYFA1304	free	KY Agric. Exp. Station
KYFA1305	free	KY Agric. Exp. Station
KYFA1306	free	KY Agric. Exp. Station
KYFA1404	free	KY Agric. Exp. Station
KYFA1405	free	KY Agric. Exp. Station
KYFA1704	free	KY Agric. Exp. Station
KYFA9304	free	KY Agric. Exp. Station
KYFA9611	free	KY Agric. Exp. Station
KYFA9732/AR584	novel	KY Agric. Exp. Station
KYFA9821/AR584	novel	KY Agric. Exp. Station
RADMRF20	free	Radix Research
STF50	free	Smith Seed Services
7FAC82	free	Barenbrug USA
7016	free	KY Agric. Exp. Station

¹ Free-varieties that do not contain an endophyte. Toxic-KY31+ contains a toxic endophyte. Novel-varieties that contain an endophyte that aids persistence but is not toxic to cattle.

² Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.

Table 15. Proprietors of orchardgrass varieties in current grazing trials in Kentucky

Variety	Proprietor/ KY distributor
Commercial Varieties-Available for Farm Use	
Devour	Mountain View Seeds
Elise	Pure Seed
Harvestar	Columbia Seeds
Persist	Smith Seed Services
Potomac	Public
Prairie	Turner Seed
Prodigy	Caudill Seed
Profit	Ampac Seed Co.
SS-0708OGDT	Southern States
Tekapo	Ampac Seed Co.
Swante	Smith Seed Services
Experimental Varieties¹	
DgLF48	Barenbrug USA
Dg82Ro1	Barenbrug USA
KYDG1001	KY Agric. Exp. Station
KYDG1002	KY Agric. Exp. Station
OG-0707	Allied
SOG-1614	Smith Seed Services
18-DgLF92	Barenbrug USA
18-DgLF93	Barenbrug USA

¹ Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.

Table 16. Proprietors of perennial ryegrass and festulolium (FL) varieties in current grazing trials in Lexington, Kentucky

Variety	Proprietor/ KY Distributor
Commercial Varieties-Available for Farm Use	
Albion	Grassland Oregon
Barvitra	Barenbrug USA
BG34	Barenbrug USA
Calibra	DLF Pickseed
Duo (FL)	Ampac Seed Co.
Linn (certified)	Public
Melpetra	Hood River Seed
PayDay	Mountain View Seeds
Power	Ampac Seed Co.
Remington	Barenbrug USA
Remington PLUS NEA2 ¹	Barenbrug USA
SpringGreen (FL)	Rose Agri-Seed
TetraGain	Pure Seed
TetraMag	Mountain View Seeds
TetraSweet	Mountain View Seeds
Victorian	Caudill Seed
Experimental Varieties²	
BARLP15261	Barenbrug USA
BARLP15COW	Barenbrug USA
BARLP16237	Barenbrug USA
BARLP16238	Barenbrug USA
BARLP17237	Barenbrug USA
BARLP17253	Barenbrug USA
BARLPF253	Barenbrug USA
GPD-14017	Ag. Research
GPD-14018	Ag. Research
GPD-14019	Ag. Research
GPT-14021	Ag. Research
GPT-14023	Ag. Research
KYFA1013 (FL)	KY Agric.Exp. Station
KYFL1301 (FL)	KY Agric.Exp. Station
KYFA9819 (FL)	KY Agric.Exp. Station
TAL-PR-02	Ag. Research
TAL-PR-03	Ag. Research
TAL-PR-04	Ag. Research

¹ Remington PLUS NEA2 contains a non-toxic (novel) endophyte.

² Experimental varieties are not available commercially but provide an indication of the progress being made by forage breeding companies.

Table 18. Summary of 2000-2019 Kentucky orchardgrass grazing tolerance trials (stand persistence shown as a percent of the mean of the commercial varieties in the trial)

Variety	Proprietor	Lexington											Princeton		Mean ⁴ (#trials)			
		2000 ^{1,2}	2001	2002	2003	2004	2005 ³	2007	2009	2010	2011	2012	2013 ³	2014		2015	2016	
		4yr ⁵	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr		4yr	4yr	
Abertop	Pennington Seed			38														
Albert	Univ. of Wisconsin		115															
Amba	DLF-Jenks		71															
Ambrosia	Pennington Seed						94											
Athos	DLF-Jenks		93				60											
Benchmark	Southern States	118	123	114												133	122(4)	
Benchmark Plus	Southern States			120					152	135	106	106	108	115	146	154	133	122(8)
Boone	Public	102																
Command	Seed Research of OR					81												
Crown Royale	Donley Seed		100															
Crown Royale Plus	Donley Seed			124													83	104(2)
Devour																		
Elise	Pure Seed															125		
Hallmark	James VanLeeuwen		115		113											74		86(
Harvestar	Columbia Seeds																83	86(2)
Haymate	Southern States	53	115	100	118				75	75	89	89	94	51	34	81		71(6)
Intensiv	Barenbrug USA				51													94(5)
Mammoth	DLF-Jenks		115															
Megabite	Turf Seed		77															
Niva	DLF-Jenks			76														
Persist	Smith Seed																	
Potomac (certified)	Public			116		119												
Prairie	Turner Seed	127	121															
Prodigy	Caudill Seed																	
Profile	Scott Seed			116														
Profit	Ampac Seed																	
Tekapo	Ampac Seed		55	74	118						95	99	102	94	95	82		94(6)
Takana	Smith Seed		99								95	105	106	80	63	77	100	84(13)
Seco	Southern States									85								
SS07080GDT	Southern States														128	131	102	120(3)

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 2010 was grazed 4 years so the final report would be "2014 Cool-Season Grass Grazing Tolerance Report" (PR-684) archived in the UK Forage website at forages.ca.uky.edu.

3 Due to high variation during 2005 and 2013 trials these values are not included in the overall mean

4 Mean only presented when respective variety was included in two or more trials.

5 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 19. Summary of 2000-2019 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	Type	Proprietor	2000 ^{1,2}		2001		2003		2007		2008		2010		2011		2012		2013		2014		2015		2016		Mean ³ (#trials)
			4yr ⁴	128	3yr	86	4yr	139	4yr	86	4yr	101	4yr	116	4yr	112	4yr	104	4yr	120	4yr	88	4yr	97	4yr	108	
AGR1P103	—	AgResearch USA						86																			107(2)
Albion	tetraploid	Grassland Oregon																					120				—
Aries	diploid	Ampac Seed																									—
Barfest (FL)	MF x PR ⁶	Barenbrug USA											116														114(2)
Barvitra	diploid	Barenbrug USA																					35				—
BG-34	diploid	Barenbrug USA																					83				—
Boost	tetraploid	Allied Seed										101															96(4)
Calibra	tetraploid	DLF International																							108		103(4)
Citadel	tetraploid	Donley Seed		107																							—
Duo (FL)	MF x PR ⁶	Ampac Seed		116																					67		89(7)
Lasso	diploid	DLF-Jenks		130																							—
Linn (certified)	diploid	Public		112																							96(11)
Maverick	tetraploid	Ampac Seed		36																							—
Meadow Green (FL)	MF x IR ⁶	Pure Seed																									—
Melpetra	tetraploid	Hood River Seed																							106		—
PayDay	tetraploid	Mountain View Seeds																									93(2)
Polly II	tetraploid	FS Growmark		36																							52(2)
Power	tetraploid	Ampac Seed																									105(7)
Quartet	tetraploid	Ampac Seed																									68(2)
Remington	tetraploid	Barenbrug USA																									151(3)
Remington PLUS NEA2 ⁵	tetraploid	Barenbrug USA																									158(3)
Spring Green (FL)	MF x PR ⁶	Rose Agri-Seed		101																							105(7)
TetraGain	tetraploid	Pure Seed																									—
Victorian	diploid	Caudill Seed																									—

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 2010 was grazed 4 years so the final report would be "2014 Cool-Season Grass Grazing Tolerance Report" (PR-684) archived in the UK Forage website at forages.ca.uky.edu.
 3 Mean only presented when respective variety was included in two or more trials.
 4 Number of years of data.
 5 Remington PLUS NEA2 contains a non-toxic (novel) endophyte.
 6 MF=meadow fescue, PR=perennial ryegrass, IR=Italian ryegrass.



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