University of Kentucky
College of Agriculture, Food and Environment
Agricultural Experiment Station

2021 Cool-Season Grass Grazing Tolerance Report

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Introduction

Cool-season forages, such as tall fescue, orchardgrass, and Kentucky bluegrass, are the primary pasture grasses in Kentucky. Other species, such as perennial ryegrass and festulolium, can also 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 growing season. Overgrazing is not a recommended practice, but is done in these studies to determine how different varieties perform under conditions that are worse than occur during the life of a typical pasture. Varieties are primarily rated for percent survival but data on seedling vigor and grazing preference are also presented. Consult the UK Forage Extension website (https://forages.ca.uky.edu) to access all forage variety testing reports from Kentucky and surrounding states as well as from a large number of other forage publications.

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2018, 2019, 2020, and 2021.

	2018				2019				2020				2021[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	31	0	2.01	-0.85	33	+2	4.11	+1.25	40	+9	3.72	+0.86	34	+3	4.51	+1.65
FEB	45	+10	9.77	+6.56	42	+7	7.64	+4.43	38	+3	5.14	+1.93	31	-4	4.6	+1.39
MAR	42	-2.	5.16	+0.76	43	-1	3.49	-0.91	51	+7	3.79	-0.61	50	+6	5.12	+0.72
APR	50	-5	5.52	+1.64	54	+4	4.76	+0.88	52	-3	4.92	+1.04	54	-1	2.72	-1.16
MAY	73	+9	8.39	+3.92	69	+5	4.49	+0.02	62	-2	5.69	+1.22	62	-2	4.34	-0.13
JUN	76	+4	6.42	+2.76	73	+1	6.13	+2.47	72	0	2.56	-1.10	73	+1	6.26	+2.60
JUL	77	+1	6.15	+1.15	79	+3	3.30	-1.70	79	+3	3.23	-1.77	75	-1	5.9	+0.90
AUG	77	+2	6.45	+2.52	77	+2	2.42	-1.51	75	0	3.41	-0.52	76	+1	6.16	+2.23
SEP	74	+6	12.88	+9.68	77	+9	0.18	-3.02	68	0	4.43	-+0.83	69	+1	3.03	-0.17
OCT	59	+2	6.54	+3.97	61	+4	7.55	+5.58	57	0	4.98	+2.41	62	+5	3.68	-1.11
NOV	42	-3	5.64	+2.25	41	-4	5.39	+2.00	49	+4	2.18	-1.21				
DEC	40	+4	7.35	+3.37	43	+7	5.74	+1.76	36	0	2.27	-1.71				
Total			82.28	+37.73			55.20	+10.65			45.92	+1.37			46.32	+9.14

[1] DEP is departure from the long-term average.
[2] 2021 data is for ten months through October.

Important Selection Considerations

Local adaptation and seasonal yield. Select a variety that is adapted to Kentucky as indicated by superior performance across years and locations in replicated trials, such as those reported in this publication. Grazing persistence data should be used in combination with yield data to select the best variety for pasture 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 ensure 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 2017, 2018, 2019, and 2020. 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 were made in the fall several weeks after the cattle were removed and in the spring prior to resuming grazing to assess 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 2. 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] 2018 May 18	2020 May 14	2021 Apr 26	Percent Stand 2017 Oct 12	2018 Mar 14	2018 Oct 16	2019 Mar 28	2019 Oct 18	2020 Mar 19	2020 Oct 13	2021 Mar 29	2021 Oct 7
Commercial Varieties-Available for Farm Use														
Jesup MaxQ	novel	3.8	1.0	2.0	1.0	99	99	99	99	99	99	99	99	99*
KY31+	toxic	4.1	1.0	3.3	1.0	100	100	100	99	99	99	99	99	99*
SS0705TFSL	free	4.3	1.0	2.7	1.0	100	100	99	99	99	98	98	98	98*
Cajun II	free	3.5	1.0	2.0	1.0	99	99	98	98	98	98	98	98	98*
Lacefield MaxQII	novel	4.2	1.0	2.8	1.0	100	100	99	98	98	98	98	98	98*
Bull	free	3.3	1.0	1.0	1.0	98	99	99	97	97	97	97	97	97*
Ranchero	free	2.7	1.0	2.5	1.0	96	97	97	97	97	97	97	97	97*
BarOptima PLUS E34	novel	4.1	1.2	3.3	1.0	100	100	98	97	96	95	95	95	95
Experimental Varieties														
KY31-	free	4.1	1.0	2.7	1.0	99	99	99	99	98	98	98	98	98*
KYFA1305	free	3.9	1.2	3.3	1.0	99	100	99	99	99	99	99	99	98*
KYFA1306	free	4.1	1.0	2.5	1.0	99	99	99	98	98	98	98	98	98*
KYFA1404	free	3.2	1.0	2.5	1.0	98	98	98	98	98	98	98	98	98*
KYFA1405	free	3.0	1.0	3.0	1.0	97	97	98	98	98	98	98	98	98*
KYFA1304	free	3.7	1.0	2.5	1.0	98	99	99	98	98	98	98	96	96*
KYFA9304	free	4.6	1.0	3.2	1.0	100	100	99	98	98	98	98	95	95
BARFA6BTR179	novel	3.6	2.2	3.3	1.0	100	100	93	93	93	91	91	91	91
Mean		3.8	1.1	2.7	1.0	99	99	98	98	98	97	97	97	97
CV,%		18.0	21.5	25.5	0.0	1	1	2	2	2	2	2	3	3
LSD,0.05		0.8	0.3	0.8	0.0	1	2	2	2	2	2	2	3	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; 2018-18 days, 2020-30 days, 2021-14days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 3. Seedling vigor, grazing preference, 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, 2018	Grazing Preference[3] 2020 May 14	2021 Apr 26	Percent Stand 2018 Sep 28	2019 Mar 28	2019 Oct 18	2020 Mar 19	2020 Oct 13	2021 Mar 29	2021 Oct 7
Commercial Varieties-Available for Farm Use											
Lacefield MaxQII	novel	3.8	2.3	1.0	88	91	91	91	91	92	92*
KY31+	toxic	2.8	3.5	1.0	90	93	93	93	93	92	92*
Jesup MaxQ	novel	2.8	2.2	1.0	81	87	89	90	90	90	91*
SS0705TFSL	free	3.8	3.0	1.0	89	90	90	90	90	88	89*
Cajun II	free	3.4	2.5	1.0	83	87	86	89	88	88	88*
Bull	free	3.3	2.2	1.0	81	85	86	87	87	87	87*
BarOptima PLUS E34	novel	3.3	3.0	1.0	83	84	84	84	84	83	84*
Experimental Varieties											
KYFA9304	free	3.3	2.8	1.0	90	89	90	91	91	91	91*
RADMRF20	free	3.4	3.3	1.0	90	89	91	91	91	91	90*
KY31-	free	3.5	2.7	1.0	88	87	88	89	89	89	88*
7016	free	3.7	3.3	1.0	87	87	88	88	88	88	87*
BARFAF137	free	3.1	4.0	1.0	82	85	88	86	86	86	86*
KYFA9611	free	2.9	3.3	1.0	84	85	86	87	87	86	86*
KYFA9821/AR584	novel	3.0	2.5	1.0	82	83	83	83	83	85	85*
BARFAF131	free	2.0	2.7	1.0	70	79	79	79	79	80	78
7FAC82	free	3.6	2.8	1.0	88	89	88	88	88	76	76
BARFABTR7NEA23	novel	2.2	3.0	1.0	78	80	80	81	75	77	75
KYFA1704	free	3.0	3.3	1.0	78	77	77	75	73	73	75
BARFA6BR-179	novel	2.5	3.3	1.0	81	82	79	77	73	74	74
BARFAF135	free	2.8	3.8	1.0	82	82	83	83	79	69	71
Mean		3.1	3.0	1.0	84	85	86	86	85	84	84
CV,%		23.3	31.3	0.0	10	8	8	8	9	11	11
LSD,0.05		0.9	1.1	0.0	10	8	8	8	9	11	11

[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; 2020-30 days, 2021-14 days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 4. Seedling vigor, grazing preference, and stand persistence of tall fescue and meadow fescue (MF) varieties sown September 5, 2019, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 25, 2019	Grazing Preference[3] 2020 Apr 22	Grazing Preference[3] 2021 Apr 26	Percent Stand 2019 Oct 25	Percent Stand 2020 Mar 19	Percent Stand 2020 Oct 13	Percent Stand 2021 Mar 29	Percent Stand 2021 Oct 7
Commercial Varieties-Available for Farm Use									
BarOptima PLUS E34	novel	3.7	4.5	1.5	100	100	100	100	100*
Estancia Arkshield	novel	3.6	4.8	1.7	100	100	100	100	100*
Jesup MaxQII	novel	2.8	4.5	1.0	100	100	100	100	100*
KY31+	toxic	3.8	4.3	1.3	100	100	100	100	100*
Lacefield MaxQII	novel	3.6	4.5	1.2	100	100	100	100	100*
SS0705TFSL	free	3.4	4.5	1.5	100	100	100	100	100*
STF43	free	3.7	5.7	2.5	100	100	100	100	100*
Cajun II	free	3.6	3.8	1.0	100	100	100	100	100*
Armory	free	3.2	5.2	1.2	99	100	99	99	99*
Ranchero	free	3.8	4.0	1.2	100	100	100	100	98*
Texoma MaxQII	novel	3.5	4.8	1.2	100	100	100	100	95*
Pradel (MF)	free	4.5	5.2	6.3	100	100	99	98	68
BARFPHDR (MF)	free	3.9	5.8	6.5	100	100	100	100	60
Experimental Varieties									
KY31-	free	4.0	4.7	1.3	100	100	100	100	100*
SETFN97	free	2.8	4.5	1.0	100	100	100	100	100*
KYFA9611	free	3.6	5.7	3.5	100	100	100	100	98*
GA95101T	free	3.7	4.5	1.5	99	100	99	99	98*
GA29	free	1.3	5.2	1.0	67	94	93	93	94*
BARFA9125	free	2.8	5.3	2.3	100	100	100	100	87
KYFP1301 (MF)	free	4.3	5.2	6.5	100	100	100	100	63
Mean		3.5	4.8	2.3	98	100	100	100	93
CV,%		17.6	15.8	36.2	4	1	1	1	8
LSD,0.05		0.7	0.9	0.9	5	1	1	2	8

[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; 2020-30 days, 2021-14 days.
*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 13. Statistical analyses were performed on all entries (including experimentals) to determine if the apparent differences are truly due to variety. 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 regarding 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 grazing tolerant varieties? Several fescue varieties were comparable to KY31+ in regard to grazing tolerance even after three or four seasons (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.

How to Interpret the Summary Tables

Tables 17, 18, and 19 are summaries of stand persistence data from 2000 to 2021 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, the stand survival ratings of all varieties is expressed as a percent of KY31+, with KY31+ set to 100. Varieties with percentages over 100 persisted better than KY31+, and those with percentages less than 100 persisted less well 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 value for each trial is set at 100 percent. Varieties with percentages over 100 persisted better than average, and varieties with percentages less than 100 persisted less well than average. Direct, statistical comparisons of varieties cannot be made using the summary tables 17, 18, and 19, but these comparisons can 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 more information can be found in the yearly reports. See the 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. Overgrazing tall fescue or orchardgrass is not recommended. Although several varieties expressed tolerance to the level of grazing pressure used in these trials, overgrazing greatly reduces yield, persistence and therefore profitability of these varieties. This information should be an indication of those varieties that will better withstand 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 www.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)
- Weed Management in Grass Pastures, Hayfields and Other Farmstead Sites (AGR-172)

Table 5. Seedling vigor, grazing preference, and stand persistence of tall fescue varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 2. 2020	Grazing Preference[3] Apr 26, 2021	Percent Stand 2020 Oct 2	Percent Stand 2021 Mar 29	Percent Stand 2021 Oct 7
Commercial Varieties-Available for Farm Use						
Armory	free	4.3	2.7	100	100	100*
BarOptima PLUS E34	novel	4.6	2.7	100	100	100*
Cajun II	free	4.6	2.2	100	100	100*
Estancia Arkshield	novel	4.1	2.7	100	100	100*
Evergraze	free	4.5	3.0	100	100	100*
Goliath	free	4.6	2.5	100	100	100*
Jesup MaxQ	novel	4.7	2.2	100	100	100*
KY31+	toxic	4.5	3.0	100	100	100*
Lacefield MaxQII	novel	4.3	2.7	100	100	100*
Ranchero	free	4.5	2.2	100	100	100*
SS0705TFSL	free	4.8	3.0	100	100	100*
STF43	free	4.3	3.0	100	100	100*
Experimental Varieties						
BAR 9301BTR1	novel	4.5	3.0	100	100	100*
BAR BTR7 NEA21	novel	3.5	2.3	100	100	100*
BAR BTR7 NEA23	novel	4.2	2.8	100	100	100*
BAR FA6 BTR 179	novel	4.2	2.5	100	100	100*
BAR FAF135	free	4.6	3.2	100	100	100*
BAR FAF137	free	4.8	3.0	100	100	100*
KY31-	free	4.8	3.0	100	100	100*
KYFA9611	free	4.2	3.3	100	100	100*
RAD-ERFH82	free	3.9	3.2	100	100	100*
SETFN97	free	4.3	2.7	100	100	100*
Mean		4.4	2.8	100	100	100
CV,%		8.0	14.6	0	0	0
LSD,0.05		0.4	0.5	0	0	0

[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; 2021-14 days.
*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 9, 2017, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 12, 2017	Grazing Preference[2] 2018 May 18	Grazing Preference[2] 2020 May 14	Grazing Preference[2] 2021 Apr 26	Percent Stand 2017 Oct 12	Percent Stand 2018 Mar 14	Percent Stand 2018 Oct 16	Percent Stand 2019 Mar 28	Percent Stand 2019 Nov 5	Percent Stand 2020 Mar 19	Percent Stand 2020 Oct 27	Percent Stand 2021 Mar 29	Percent Stand 2021 Oct 22
Commercial Varieties-Available for Farm Use													
Persist	3.7	2.0	2.2	3.0	98	98	94	88	70	54	40	38	35*
Potomac	3.7	2.7	2.5	4.0	98	99	96	95	73	63	37	38	33*
Prodigy	4.3	2.5	2.8	3.8	100	100	95	91	67	49	41	33	33*
SS0708OGDT	4.4	2.2	2.3	3.8	99	99	96	93	70	50	35	37	32*
Prairie	3.4	3.2	2.8	3.7	97	99	93	87	64	45	28	25	18
Experimental Varieties													
SOG-1614	2.6	7.3	2.8	3.8	92	93	91	85	58	32	25	20	23
Mean	3.7	3.3	2.6	3.7	97	98	94	90	67	49	34	32	29
CV,%	15.8	22.7	22.7	27.3	2	2	4	6	19	27	33	31	31
LSD,0.05	0.7	0.9	0.7	1.2	2	2	4	6	15	16	13	12	11

[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, 2020-30 days, 2021-14days.
*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, 5, 2018, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1]	Grazing Preference[2]		Percent Stand						
		2020	2021	2018	2019		2020		2021	
	Sep 28, 2018	May 14	Apr 26	Sep 28	Mar 28	Nov 5	Mar 19	Oct 27	Mar 29	Oct 22
Commercial Varieties-Available for Farm Use										
Persist	4.3	2.2	4.2	96	96	96	96	89	84	78*
Prairie	4.7	2.3	4.0	95	96	95	95	89	84	65*
SS0708OGDT	4.7	2.3	3.8	97	97	96	96	82	69	61
Prodigy	4.4	2.5	4.0	94	94	92	84	64	58	52
Swante	1.8	2.8	5.2	73	79	68	43	33	28	28
Experimental Varieties										
DgLF48	3.7	2.5	3.8	92	92	91	91	83	78	68*
18-DgLF93	2.8	2.5	4.3	88	85	86	83	58	48	44
18-DgLF92	3.3	3.2	4.3	93	92	90	87	61	52	38
Mean	3.8	2.5	4.2	92	97	90	86	71	64	55
CV,%	16.5	21.8	27.6	8	7	6	11	23	28	24
LSD,0.05	0.8	0.6	1.4	9	8	6	12	20	22	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; 2020-30 days, 2021-14days.
*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 5, 2019, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1]	Grazing Preference[2]		Percent Stand				
		2020	2021	2019	2020		2021	
	Oct 25, 2019	Apr 22	Apr 26	Oct 25	Mar 19	Oct 13	Mar 29	Oct 22
Commercial Varieties-Available for Farm Use								
SS0708OGDT	4.3	3.0	3.7	100	100	99	99	83*
Persist	4.2	3.0	3.3	100	100	99	99	82*
BARDGLHLR	3.6	4.7	4.8	98	99	93	91	80*
Prodigy	4.2	3.3	3.2	99	100	98	98	78*
Prairie	3.9	3.5	3.8	99	99	99	98	76
Experimental Varieties								
SEOGP2	3.8	3.8	3.7	99	100	98	97	82*
Mean	4.0	3.6	3.8	99	100	98	97	80
CV,%	16.1	22.1	26.3	1	1	2	3	7
LSD,0.05	0.8	0.9	1.2	2	1	3	4	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; 2020-8 days, 2021-14 days.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

About the Authors

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Table 9. Seedling vigor, grazing preference, and stand persistence of orchardgrass varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 2, 2020	Grazing Preference[2] Apr 26, 2021	Percent Stand 2020 Oct 2	2021 Mar 29	2021 Oct 7
Commercial Varieties-Available for Farm Use					
Devour	4.2	5.0	100	100	100*
HLR	4.2	4.5	100	100	100*
Intensiv	4.4	4.3	100	100	100*
Prairie	4.3	4.5	100	100	100*
Profit	3.8	4.7	100	100	100*
Persist	4.1	4.5	100	100	100*
Swante	4.3	5.2	100	100	100*
Experimental Varieties					
BARDGLF94	4.0	5.2	100	100	100*
SEOGP2	4.3	4.7	100	100	100*
BARDGLF95	3.3	5.0	100	100	99
Mean	4.1	4.8	100	100	100
CV,%	9.1	9.3	0	0	1
LSD,0.05	0.4	0.5	0	0	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; 2021-14 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 varieties sown September 9, 2017, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 12, 2017	Grazing Preference[2] 2018 May 18	2019 May 20	2020 May 14	2021 Apr 26	Percent Stand 2017 Oct 12	2018 Mar 14	2018 Oct 16	2019 Mar 28	2019 Oct 18	2020 Mar 19	2020 Oct 13	2021 Mar 29	2021 Oct 22
Commercial Varieties-Available for Farm Use														
Remington	4.4	4.0	2.0	4.0	4.0	99	99	98	97	95	95	88	93	91*
Victorian	4.8	3.2	2.0	2.0	3.3	100	84	88	91	85	88	79	82	80*
PayDay	3.6	3.8	3.3	3.2	5.3	98	99	96	94	76	78	67	84	73
TetraGain	3.4	3.6	2.8	3.3	4.4	97	98	74	73	56	59	54	70	66
Linn (certified)	4.6	2.3	2.8	2.8	4.0	100	100	85	76	56	56	50	60	58
Experimental Varieties														
BARLP17237	3.3	4.5	2.2	3.5	5.3	97	98	99	98	96	94	88	91	86*
BARLM16238	4.6	3.3	2.2	3.0	3.8	100	100	90	88	68	70	76	70	82*
BARLP17253	4.1	3.3	3.2	3.3	4.0	99	100	92	94	58	64	69	68	74
Mean	4.1	3.5	2.6	3.1	4.3	99	97	90	88	73	75	71	77	76
CV,%	10.4	20.7	55.0	16.4	27.0	1	6	12	11	21	20	18	18	18
LSD,0.05	0.5	0.9	1.8	0.6	1.4	1	6	13	12	18	17	15	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; 2018-18 days, 2019-30 days, 2020-30 days, 2021-14days.
*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 varieties sown September 5, 2018, in a cattle-grazing tolerance study at Lexington, Kentucky.

	Seedling	Grazing Preference[2]			Percent Stand						
	Vigor[1]	2019	2020	2021	2018	2019		2020		2021	
Variety	Sep 28, 2018	May 20	May 14	Apr 26	Sep 28	Mar 28	Oct 18	Mar 19	Oct 13	Mar 29	Oct 22
Commercial Varieties-Available for Farm Use											
Remington PLUS NEA2[3]	4.4	3.7	3.5	4.0	98	98	99	97	98	98	96*
Remington	4.8	3.7	3.3	4.5	100	100	100	100	99	99	96*
Calibra	4.4	3.0	3.2	4.5	100	100	97	97	94	95	91
TetraSweet	4.8	3.0	3.0	3.8	100	99	97	97	95	96	88
PayDay	4.3	3.2	2.8	5.0	100	99	98	98	95	97	87
Linn (certified)	4.4	1.0	2.3	3.0	100	95	93	93	88	89	86
TetraMag	4.8	3.3	3.0	5.5	100	100	91	92	86	88	83
Experimental Varieties											
BARLPF253	4.0	2.5	3.2	4.5	100	99	97	96	96	95	90
Mean	4.5	2.9	3.0	4.4	100	99	96	96	94	95	89
CV,%	10.3	18.9	18.8	16.5	1	2	3	3	4	4	5
LSD,0.05	0.5	0.6	0.7	0.8	1	2	3	3	4	4	5

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating; 2019-30 days, 2020-30 days 2021-14 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 12. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass varieties sown September 5, 2019, in a cattle-grazing tolerance study at Lexington, Kentucky.

	Seedling	Grazing Preference[2]		Percent Stand				
	Vigor[1]	2020	2021	2019	2020		2021	
Variety	Oct 25, 2019	Apr 22	Apr 26	Oct 25	Mar 19	Oct 13	Mar 29	Oct 22
Commercial Varieties-Available for Farm Use								
Remington	4.5	4.8	2.7	100	100	100	100	97*
Remington PLUS NEA2[3]	4.0	5.0	2.7	100	100	100	100	97*
Linn	4.6	2.2	1.5	100	100	100	100	96*
TetraSweet	4.3	4.0	3.2	100	100	100	100	94*
PayDay	4.6	3.8	3.8	100	100	100	100	93*
TetraMag	4.8	3.5	4.5	100	100	99	99	89
Mean	4.4	3.9	3.1	100	100	100	100	94
CV,%	8.3	16.6	28.4	0	0	1	1	3
LSD,0.05	0.4	0.8	1.0	0	0	1	1	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; 2020-8 days 2021-14 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 13. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

	Seedling	Grazing	Percent Stand		
	Vigor[1]	Preference[2]	2020	2021	
Variety	Oct 2, 2020	Apr 26, 2021	Oct 2	Mar 29	Oct 7
Commercial Varieties-Available for Farm Use					
PayDay	4.1	4.7	100	100	100*
Remington	3.9	5.0	100	100	100*
Remington PLUS NEA2[3]	4.1	5.3	100	100	100*
Power	4.3	4.7	100	100	100*
Linn	4.9	3.2	100	100	97
Experimental Varieties					
BARLPF237	3.9	5.2	100	100	100*
Mean	4.2	4.7	100	100	99
CV,%	9.3	10.2	0	0	1
LSD,0.05	0.5	0.6	0	0	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; 2021-14 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 Lexington, Kentucky.

Variety	Endophyte Status[1]	Proprietor/ KY Distributor
Commercial Varieties-Available for Farm Use		
Armory	free	Barenbrug USA
BarOptima PLUS E34	novel	Barenbrug USA
Bull	free	Caudill Seed
Cajun II	free	Smith Seed Services
Estancia Arkshield	novel	Mountain View Seeds
Evergraze	free	Bailey Seed and Grain
Goliath	free	Ampac Seed
Jesup MaxQ	novel	Pennington Seed
Jesup MaxQII	novel	Pennington Seed
KY 31+	toxic	KY Agric. Exp. Station
Lacefield MaxQ II	novel	Pennington Seed
Ranchero	free	Smith Seed Services
SS-0705TFSL	free	Southern States
STF43	free	Barenbrug USA
Texoma MaxQII	novel	Pennington Seed
Experimental Varieties[2]		
BARFA6BTR179	novel	Barenbrug USA
BAREA9125	free	Barenbrug USA
BAR BTR7 NEA1	novel	Barenbrug USA
BARFABTR7NEA23	novel	Barenbrug USA
BARFAF131	free	Barenbrug USA
BARFAF135	free	Barenbrug USA
BARFAF137	free	Barenbrug USA
BAR 9301BTR1	novel	Barenbrug USA
GA29	free	Univ. of GA
GA95101T	free	Univ. of GA
KY 31-	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
KYFA9821/AR584	novel	KY Agric. Exp. Station
RAD-ERFH82	free	Radix Research
RADMRF20	free	Radix Research
SETFN97	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 Lexington, Kentucky.

Variety	Proprietor/ KY Distributor
Commercial Varieties-Available for Farm Use	
BAR DGL HLR	Barenbrug USA
Devour	Mountain View Seeds
HLR	Barenbrug USA
Intensiv	Barenbrug USA
Persist	Smith Seed Services
Potomac	Public
Prairie	Turner Seed
Prodigy	Caudill Seed
Profit	Ampac Seed
SS-0708OGDT	Southern States
Swante	Smith Seed Services
Experimental Varieties[1]	
BARDGLF94	Barenbrug USA
BARDGLF95	Barenbrug USA
DgLF48	Barenbrug USA
SEOGP2	Smith Seed Services
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 varieties in current grazing trials in Lexington, Kentucky.

Variety	Proprietor/ KY Distributor
Commercial Varieties-Available for Farm Use	
Calibra	DLF Pickseed
Linn (certified)	Public
PayDay	Mountain View Seeds
Power	Ampac Seed Co.
Remington	Barenbrug USA
Remington PLUS NEA2[1]	Barenbrug USA
TetraGain	Pure Seed
TetraMag	Mountain View Seeds
TetraSweet	Mountain View Seeds
Victorian	Caudill Seed
Experimental Varieties[2]	
BARLP16238	Barenbrug USA
BARLP17237	Barenbrug USA
BARLP17253	Barenbrug USA
BARLPF237	Barenbrug USA
BARLPF253	Barenbrug USA

[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 17. Summary of 2001-2021 Kentucky tall fescue grazing tolerance trials in Lexington (stand persistence shown as a percent of the stand rating of KY 31+).

Variety	Endophyte Status[1]	Proprietor	2001[2,3] 4yr[5]	2002 4yr	2003 4yr	2004 4yr	2005 4yr	2006 4yr	2007 4yr	2008 4yr	2009 4yr	2010 4yr	2011 4yr	2012 4yr	2013 4yr	2014 4yr	2015 4yr	2016 4yr	2017 4yr	2018 3yr	Mean[4] (#trials)
Advance MaxQ	novel	Pennington Seed						94													–
Baguala	free	Allied Seed															99				–
Bariane	free	Barenbrug USA			89		75	47	29												60(4)
BarElite	free	Barenbrug USA							96												–
Barolex	free	Barenbrug USA					78	101	86												88(3)
BarOptima PLUS E34	novel	Barenbrug USA					100		97			98	100	98	100	100	100	100	96	91	98(11)
Bronson	free	Ampac Seed									98	98						100			99(3)
Bull	free	Caudill Seed													96			100	98	95	97(4)
Cajun II	free	Smith Seed Services										98				97	100	100	99	96	98(6)
Cattle Club	free	Green Seed	91																		–
Carmine	free	DLF-Jenks	90																		–
Cowgirl	free	Rose Agri-Seed				99								99							99(2)
Dominate	free	Allied Seed															99				–
Drover	free	Barenbrug USA															99				–
Festival	free	Pickseed West	100	101																	101(2)
FSG 402TF	free	Farm Service Genetics															99				–
Flourish	free	Allied Seed												98							–
Goliath	free	Ampac Seed										98						100			99(2)
HyMark	free	Fraser Seeds								95			100								98(2)
Jesup MaxQ	novel	Pennington Seed		103	97		68	102	97	97	99	98	100	99	99	99	100	100	100	98	97(16)
Johnstone	free	Proseeds	92																		–
KY31+	toxic	KY Agri. Exp Sta.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100(18)
KY31-	free	KY Agri. Exp Sta.	98	103	98	100	83	101	100	98	99	99	100	100	99	100	100	100	99	91	98(18)
Lacefield MaxQ II	novel	Pennington Seed					82	102	99	98	98	97			100	99	100	100	99	100	98(12)
Maximize	free	Rose Agri-Seed	99																		–
Nanryo	free	Japanese Grassland For.Seed							100												–
Orygun	free	–		99																	–
Ranchero	free	Smith Seed Services																	98		–
Select	free	Southern States	101	100	100		67	100	93	95	97	100	100	99	99	99	101				97(14)
SS0705TFSL	free	Southern States														100	100	100	99	97	99(5)
Stargrazer	free	Southern States	89																		88(2)
Stockman	free	Seed Res. of OR				102															–
Texoma MaxQ II	novel	Pennington Seed					88	100	98												95(3)
Tuscany II	free	Seed Res. of OR						101													–
Verdant	free	Am.Grass Seed						97													–

[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] Year trial was established.
[3] 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 2016 was grazed four years so the final report would be "2020 Cool-Season Grass Grazing Tolerance Report" archived in the UK Forage website (https://forages.ca.uky.edu).
[4] Mean only presented when respective variety was included in two or more trials.
[5] Number of years of data.

Table 18. Summary of 2000-2021 Kentucky orchardgrass 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[5]	2001 4yr	2002 4yr	2003 4yr	2004 4yr	2005[3] 4yr	2007 4yr	2009 4yr	2010 4yr	2011 4yr	2012 4yr	20133 4yr	2014 4yr	2015 4yr	2016 4yr	2017 4yr	2018 3yr	Mean[4] (#trials)
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															118(3)
Benchmark Plus	Southern States			120			152	135	106	106	108	115	146	154					120(5)
Boone	Public	102																	–
Command	Seed Research of OR					81													–
Crown Royale	Donley Seed		100																–
Crown Royale Plus	Donley Seed			124															–
Devour	Mountain View Seeds															145			–
Elise	Pure Seed											97				62			80(2)
Hallmark	James VanLeeuwen		115		113														114(2)
Harvestar	Columbia Seeds							75		89	94		51	34		60			70(5)
Haymate	Southern States	53	115	100	118														97(4)
Intensiv	Barenbrug USA				51														–
Mammoth	DLF-Jenks		115																–
Megabite	Turf Seed		77																–
Niva	DLF-Jenks			76															–
Persist	Smith Seed Services						138	107	103	100	96	115	102	123	104	131	116	137	113(10)
Potomac (certified)	Public			116		119									109	82	109		107(5)
Prairie	Turner Seed	127	121								94		131	90	97	107	60	114	105(9)
Prodigy	Caudill Seed												109	119		94	109	92	104(4)
Profile	Scott Seed			116															–
Profit	Ampac Seed								95	99	102	94	95	90	82				94(6)
Tekapo	Ampac Seed		55	74	118		50	103	95	105	106	80	66	63	77				87(10)
Takena	Smith Seed Services		99																–
Seco	Southern States							85											–
SS0708OGDT	Southern States													128	131	118	106	107	118(5)
Swante	Smith Seed Services																	49	–

[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 2016 was grazed four years so the final report would be "2020 Cool-Season Grass Grazing Tolerance Report" archived in the UK Forage website (https://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 2000-2021 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] 4yr[4]	2001 3yr	2003 4yr	2007 4yr	2008 4yr	2010 4yr	2011 4yr	2012 4yr	2013 4yr	2014 4yr	2015 4yr	2016 4yr	2017 4yr	2018 3yr	Mean[3] (#trials)
AGRLP103	–	AgResearch USA	128		86												107(2)
Albion	tetraploid	Grassland Oregon											120				–
Aries	diploid	Ampac Seed		139													–
Barfest (FL)	MF x PR[6]	Barenbrug USA						116	112								114(2)
Barvitra	diploid	Barenbrug USA											35				–
BG-34	diploid	Barenbrug USA											83				–
Boost	tetraploid	Allied Seed					101	83	95	104							96(4)
Calibra	tetraploid	DLF International								120		88	97	98		102	101(5)
Citadel	tetraploid	Donley Seed	107														–
Duo (FL)	MF x PR6	Ampac Seed	116				95	72	90	115			70	65			89(7)
Lasso	diploid	DLF-Jenks		130													–
Linn (certified)	diploid	Public	112	129	63		95	108	95	103	96	80	74	88	79	96	94(13)
Maverick	tetraploid	Ampac Seed		36													–
Meadow Green (FL)	MF x IR[6]	Pure Seed								15							–
Melpetra	tetraploid	Hood River Seed												90			–
PayDay	tetraploid	Mountain View Seeds									101	85			99	97	96(4)
Polly II	tetraploid	FS Growmark	36	68													52(2)
Power	tetraploid	Ampac Seed				158		107	112	109	89	79	83				105(7)
Quartet	tetraploid	Ampac Seed		77		59											68(2)
Remington	tetraploid	Barenbrug USA			151							138	180	169	124	107	145(6)
Remington PLUS NEA2[5]	tetraploid	Barenbrug USA										145	171			107	141(3)
Spring Green (FL)	MF x PR6	Rose Agri-Seed	101				109	115	115	120			87	88			105(7)
TetraGain	tetraploid	Pure Seed								112					90		101(2)
TetraMag	tetraploid	Mountain View Seeds														93	–
TetraSweet	tetraploid	Mountain View Seeds														98	–
Victorian	diploid	Caudill Seed									114				109		112(2)

[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 2016 was grazed four years so the final report would be "2020 Cool-Season Grass Grazing Tolerance Report" archived in the UK Forage website (htpps://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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