PR-843

Agricultural Experiment Station

2023 Cool-Season Grass Grazing Tolerance Report

G.L. Olson, S.R. Smith, C.D. Teutsch, J.C. Henning, and T.D. Phillips, Plant and Soil Sciences

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.

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 2019, 2020, 2021, and 2022. 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.

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 2023 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)
- Extending Grazing and Reducing Stored Feed Needs (AGR-199)

About the Authors

G.L. Olson is a research specialist, S.R. Smith and J.C. Henning are Extension professors and forage specialists, C.D. Teutsch is an Extension associate professor and forage specialist, and T.D. Phillips is an associate professor of tall fescue and grass breeding.

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2020, 2021, 2022, and 2023.

	2020				2021				2022				2023[2]			
	Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	40	+9	3.72	+0.86	34	+3	4.51	+1.65	29	-2	4.93	+2.07	44	+13	6.28	+3.42
FEB	38	+3	5.14	+1.93	31	-4	4.60	+1.39	38	+3	7.69	+4.48	47	+12	3.73	+0.52
MAR	51	+7	3.79	-0.61	50	+6	5.12	+0.72	49	+5	4.27	-0.13	48	+4	4.45	+0.05
APR	52	-3	4.92	+1.04	54	-1	2.72	-1.16	55	0	3.71	-0.17	58	+3	2.36	-1.52
MAY	62	-2	5.69	+1.22	62	-2	4.34	-0.13	69	+5	3.84	-0.63	65	+1	2.53	-1.94
JUN	72	0	2.56	-1.10	73	+1	6.26	+2.60	76	+4	2.10	-1.56	72	0	6.75	+3.09
JUL	79	+3	3.23	-1.77	75	-1	5.90	+0.90	80	+4	6.46	+1.46	78	+2	5.32	+0.32
AUG	75	0	3.41	-0.52	76	+1	6.16	+2.23	77	+2	4.27	+0.34	76	+1	2.40	-1.53
SEP	68	0	4.43	-+0.83	69	+1	3.03	-0.17	70	+2	1.50	-1.70	71	+3	0.99	-2.21
OCT	57	0	4.98	+2.41	62	+5	4.64	+2.10	57	0	0.96	-1.61	61	+4	2.30	-0.27
NOV	49	+4	2.18	-1.21	43	-2	2.13	-1.26	49	+4	2.1	-1.29				
DEC	36	0	2.27	-1.71	47	+11	4.41	+0.43	40	+4	3.46	-0.52				
Total			45.92	+1.37			53.85	+9.30			45.29	+0.74			37.11	-0.07

[1] DEP is departure from the long-term average.
[2] 2023 data is for ten months through October.

Table 2. 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]				Percent Stand								
			2020	2021	2022	2023	2019	2020		2021		2022		2023	
			Apr 22	Apr 26	May 6	May 4	Oct 25	Mar 19	Oct 13	Mar 29	Oct 7	Mar 24	Oct 24	Mar 21	Oct 18
Commercial Varieties-Available for Farm Use															
BarOptima PLUS E34	novel	3.7	4.5	1.5	1.5	1.5	100	100	100	100	100	100	100	100	100*
Estancia Arkshield	novel	3.6	4.8	1.7	1.0	1.2	100	100	100	100	100	100	100	100	100*
Jesup MaxQII	novel	2.8	4.5	1.0	1.0	1.3	100	100	100	100	100	100	100	100	100*
KY31+	toxic	3.8	4.3	1.3	1.0	1.8	100	100	100	100	100	100	100	100	100*
Lacefield MaxQII	novel	3.6	4.5	1.2	1.0	1.0	100	100	100	100	100	100	100	100	100*
SS0705TFSL	free	3.4	4.5	1.5	1.0	1.3	100	100	100	100	100	100	100	100	100*
Armory	free	3.2	5.2	1.2	1.0	1.5	99	100	99	99	99	99	99	99	99*
Cajun II	free	3.6	3.8	1.0	1.0	1.0	100	100	100	100	100	100	99	99	99*
STF43	free	3.7	5.7	2.5	1.5	1.7	100	100	100	100	100	100	100	97	97*
Ranchero	free	3.8	4.0	1.2	1.0	1.5	100	100	100	100	98	98	97	97	96*
Texoma MaxQII	novel	3.5	4.8	1.2	1.0	1.3	100	100	100	100	95	95	95	95	95*
BARFPHDR (MF)	free	3.9	5.8	6.5	5.5	4.7	100	100	100	100	60	55	35	25	38
Pradel (MF)	free	4.5	5.2	6.3	4.7	5.2	100	100	99	98	68	63	42	18	14
Experimental Varieties															
KY31-	free	4.0	4.7	1.3	1.0	1.3	97	99	99	99	99	99	100	100	100*
SETFN97	free	2.8	4.5	1.0	1.0	1.2	100	100	100	100	100	99	100	98	98*
GA29	free	1.3	5.2	1.0	1.0	1.3	70	95	94	93	95	94	93	96	96*
GA95101T	free	3.7	4.5	1.5	1.0	1.5	99	100	99	99	98	97	96	96	84*
KYFA9611	free	3.6	5.7	3.5	2.8	2.5	100	100	100	100	98	93	92	85	61
BARFA9125	free	2.8	5.3	2.3	3.7	2.7	100	100	100	100	87	86	85	64	58
KYFP1301 (MF)	free	4.3	5.2	6.5	4.5	4.5	100	100	100	100	63	60	32	22	14
Mean		3.5	4.8	2.3	1.9	2.0	98	100	100	99	93	92	88	85	82
CV,%		17.6	15.8	36.2	45.2	31.4	5	1	1	2	8	8	10	10	19
LSD,0.05		0.7	0.9	0.9	1.0	0.7	6	1	2	2	8	9	10	10	18

[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, 2022-16 days, 2023-15 days.
* 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 Septembe 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 2, 2020	Grazing Preference[3]			Percent Stand						
			2021	2022	2023	2020	2021		2022		2023	
			Apr 26	May 6	May 4	Oct 2	Mar 29	Oct 7	Mar 24	Oct 24	Mar 21	Oct 18
Commercial Varieties-Available for Farm Use												
Armory	free	4.3	2.7	1.0	1.2	100	100	100	100	100	100	100*
BarOptima PLUS E34	novel	4.6	2.7	1.0	2.2	100	100	100	100	100	100	100*
Cajun II	free	4.6	2.2	1.0	1.0	100	100	100	100	100	100	100*
Estancia Arkshield	novel	4.1	2.7	1.0	1.0	100	100	100	100	100	100	100*
Evergraze	free	4.5	3.0	1.0	1.0	100	100	100	100	100	100	100*
Goliath	free	4.6	2.5	1.0	1.0	100	100	100	100	100	100	100*
Jesup MaxQ	novel	4.7	2.2	1.0	1.0	100	100	100	100	100	100	100*
KY31+	toxic	4.5	3.0	1.0	1.5	100	100	100	100	100	100	100*
Lacefield MaxQII	novel	4.3	2.7	1.0	1.2	100	100	100	100	100	100	100*
Ranchero	free	4.5	2.2	1.0	1.2	100	100	100	100	100	100	100*
SS0705TFSL	free	4.8	3.0	1.0	1.3	100	100	100	100	100	100	100*
STF43	free	4.3	3.0	1.0	2.8	100	100	100	100	100	100	100*
Experimental Varieties												
BAR9301 BTR1	novel	4.5	3.0	1.0	1.8	100	100	100	100	100	100	100*
BARBTR7 NEA21	novel	3.5	2.3	1.0	1.2	99	100	100	100	100	100	100*
BARBTR7 NEA23	novel	4.2	2.8	1.0	1.3	100	100	100	100	100	100	100*
BARFA6 BTR179	novel	4.2	2.5	1.0	1.5	100	100	100	100	100	100	100*
BARFAF135	free	4.6	3.2	1.0	3.0	100	100	100	100	100	100	100*
BARFAF137	free	4.8	3.0	1.0	2.5	100	100	100	100	100	100	100*
KY31-	free	4.8	3.0	1.0	1.5	100	100	100	100	100	100	100*
KYFA9611	free	4.2	3.3	1.0	2.7	100	100	100	100	100	100	100*
RAD-ERFH82	free	3.9	3.2	1.0	1.3	100	100	100	100	100	100	100*
SETFN97	free	4.3	2.7	1.0	1.0	100	100	100	100	100	100	100*
Mean		4.4	2.8	1.0	1.6	100	100	100	100	100	100	100
CV,%		8.0	14.6	0.0	33.9	0	0	0	0	0	0	0
LSD,0.05		0.4	0.5	0.0	0.6	0	0	0	0	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, 2022-16 days, 2023-15 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 varieties sown September 8, 2021, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 5, 2021	Grazing Preference[3]		Percent Stand				
			2022	2023	2021	2022		2023	
			May 6	May 4	Oct 5	Mar 24	Oct 24	Mar 21	Oct 18
Commercial Varieties-Available for Farm Use									
BarOptima PLUS E34	novel	4.5	2.5	2.5	100	100	100	100	100*
Cajun II	free	4.7	1.0	1.2	100	100	100	100	100*
Estancia Arkshield	novel	4.7	1.2	1.0	100	100	100	100	100*
Jesup MaxQII	novel	4.3	1.0	1.2	100	100	100	100	100*
KY31+	toxic	4.6	1.2	2.0	100	100	100	100	100*
Lacefield MaxQII	novel	4.9	1.3	1.2	100	100	100	100	100*
Ranchero	free	4.4	1.7	1.2	100	100	100	100	100*
SS0705TFSL	free	4.9	1.7	1.2	100	100	100	100	100*
Texoma MaxQII	novel	4.3	1.0	1.0	100	100	100	100	100*
Experimental Varieties									
KY31-	free	4.8	1.5	1.2	100	100	100	100	100*
KYFA9611	free	4.2	3.0	2.2	100	100	100	100	100*
RAD-GAN208	free	4.6	1.8	1.5	100	100	100	100	100*
SETFN97	free	4.5	1.0	1.2	100	100	100	100	100*
SETFPC-5BK	free	4.4	1.0	1.0	100	100	100	100	100*
Mean		4.6	1.5	1.4	100	100	100	100	100
CV,%		5.2	25.8	31.8	0	0	0	0	0
LSD,0.05		0.3	0.4	0.5	0	0	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: 2022-16 days, 2023-15 days.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 5. Seedling vigor, grazing preference, and stand persistence of tall fescue varieties sown September 9, 2022, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Sep 28, 2022	Grazing Preference[3] May 4, 2023	Percent Stand		
				2022	2023	
				Sep 28	Mar 21	Oct 18
Commercial Varieties-Available for Farm Use						
BarOptima PLUS E34	novel	4.8	3.0	100	100	100*
Cajun II	free	5.0	3.2	100	100	100*
Estancia Arkshield	novel	4.8	2.5	100	100	100*
Jesup MaxQII	novel	4.7	2.7	100	100	100*
KY31+	toxic	4.8	2.7	100	100	100*
Lacefield MaxQII	novel	5.0	2.7	100	100	100*
SS0705TFSL	free	5.0	2.5	100	100	100*
Texoma MaxQII	novel	4.8	2.8	100	100	100*
Experimental Varieties						
GTC16076/T10941	free	4.8	3.3	100	100	100*
GTC16077/T10942	free	4.9	3.0	100	100	100*
GTC16078/T10943	free	4.8	3.0	100	100	100*
GTC16079/T10944	free	5.0	2.7	100	100	100*
GTC16081/T11044	novel	4.8	3.0	100	100	100*
KY31-	free	4.9	2.8	100	100	100*
KYFA9732/AR584	novel	5.0	3.7	100	100	100*
RAD-TF119	free	4.8	2.8	100	100	100*
Mean		4.9	2.9	100	100	100
CV,%		4.8	22.9	0	0	0
LSD,0.05		0.3	0.8	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: 2023-15 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 5, 2019, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 25, 2019	Grazing Preference[2]				Percent Stand							
		2020	2021	2022	2023	2019	2020		2021		2022	2023	
		Apr 22	Apr 26	May 6	May 4	Oct 25	Mar 19	Oct 13	Mar 29	Oct 22	Mar 24	Mar 21	Oct 17
Commercial Varieties-Available for Farm Use													
Persist	4.2	3.0	3.3	2.7	2.2	100	100	99	99	82	73	47	42*
Persist II	3.8	3.8	3.7	2.8	2.3	99	100	98	97	82	73	48	35*
BARDGLHLR	3.3	4.7	4.8	4.0	4.0	98	99	93	91	80	63	30	27
Prairie	3.9	3.5	3.8	3.8	2.7	99	99	99	98	76	62	35	27
Prodigy	4.2	3.3	3.2	3.7	3.3	99	100	98	98	78	63	37	26
SS0708OGDT	4.3	3.0	3.7	3.2	2.7	100	100	99	99	83	70	38	26
Mean	3.9	3.6	3.8	3.4	2.9	99	100	98	97	80	68	39	30
CV,%	16.6	22.1	26.3	25.3	22.5	1	1	2	3	7	12	27	23
LSD,0.05	0.8	0.9	1.2	1.0	0.8	2	1	3	4	6	10	13	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: 2020-30 days, 2021-14 days, 2022-16 days, 2023-15 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, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 2, 2020	Grazing Preference[2]			Percent Stand						
		2021	2022	2023	2020	2021		2022		2023	
		Apr 26	May 6	May4	Oct 2	Mar 29	Oct 7	Mar 24	Oct 24	Mar 21	Oct 17
Commercial Varieties-Available for Farm Use											
Persist II	4.3	4.7	1.2	2.3	100	100	100	100	100	100	98*
Devour	4.2	5.0	2.5	3.7	100	100	100	100	100	100	98*
Persist	4.1	4.5	1.0	2.3	100	100	100	100	99	99	98*
Prairie	4.3	4.5	1.3	2.5	100	100	100	100	100	99	96*
HLR	4.2	4.5	2.8	5.2	100	100	100	100	99	97	92*
Profit	3.8	4.7	1.8	3.0	100	100	100	100	99	98	91*
Intensiv	4.4	4.3	2.7	5.8	100	100	100	100	99	91	82
Swante	4.3	5.2	2.0	6.5	100	100	100	97	90	82	69
Experimental Varieties											
BARDGLF94	4.0	5.2	4.0	6.3	100	100	100	99	96	91	85
BARDGLF95	3.3	5.0	3.3	5.7	100	100	99	98	93	83	76
Mean	4.1	4.8	2.3	4.3	100	100	100	99	97	94	88
CV,%	9.1	9.3	35.5	20.7	0	0	1	1	3	6	9
LSD,0.05	0.4	0.5	0.9	1.0	0	0	1	1	3	7	9

[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, 2022-16 days, 2023-15 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 8, 2021, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 5, 2021	Grazing Preference[2]		Percent Stand				
		2022	2023	2021	2022		2023	
		May 6	May 4	Oct 5	Mar 24	Oct 24	Mar 21	Oct 17
Commercial Varieties-Available for Farm Use								
Persist II	4.4	2.0	2.5	100	100	100	99	96*
Devour	4.4	2.8	4.7	100	100	100	97	94*
Persist	4.8	1.8	2.3	100	100	100	98	94*
Potomac	4.5	2.2	2.5	100	100	100	98	94*
SS0708OGDT	4.3	2.0	3.3	100	100	100	97	92*
Prairie	4.3	2.0	3.0	100	100	100	99	91*
Prodigy	4.7	2.0	3.8	100	100	100	96	91*
Profit	4.6	2.3	3.5	100	100	100	98	88*
Barlegro	3.3	2.5	5.5	100	100	100	97	72
Intensiv	4.9	2.5	5.7	100	100	100	95	68
Experimental Varieties								
BARDgLF99	4.1	2.5	6.0	100	100	100	96	91*
BARDgLF98	4.4	2.2	4.3	100	100	100	99	86*
BarDgLF85	4.7	1.7	4.5	100	100	100	96	83
BarDgLF84	3.9	2.0	4.3	100	100	100	96	77
Mean	4.4	2.2	4.0	100	100	100	97	87
CV,%	8.8	17.8	18.5	0	0	0	2	11
LSD,0.05	0.4	0.4	0.9	0	0	0	2	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: 2022-16 days, 2023-15 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 September 9, 2022, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Sep 28, 2022	Grazing Preference[2] May 4, 2023	Percent Stand		
			2022	2023	
			Sep 28	Mar 21	Nov 9
Commercial Varieties-Available for Farm Use					
Devour	5.0	3.5	100	100	100*
Profit	5.0	3.5	100	100	99*
Potomac	5.0	3.2	100	100	98*
Persist	4.9	3.5	100	100	98
Prodigy	4.9	3.2	100	100	97
SS0708OGDT	5.0	3.7	100	100	97
Persist II	4.9	3.7	100	100	96
Prairie	4.9	3.3	100	100	96
Mean	5.0	3.4	100	100	98
CV,%	2.6	17.2	0	0	2
LSD,0.05	0.2	0.7	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; 2023-15 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 5, 2019, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 25, 2019	Grazing Preference[2]				Percent Stand								
		2020	2021	2022	2023	2019	2020		2021		2022		2023	
		Apr 22	Apr 26	May 6	May 4	Oct 25	Mar 19	Oct 13	Mar 29	Oct 22	Mar 24	Nov 10	Mar 21	Oct 17
Commercial Varieties-Available for Farm Use														
Remington PLUS NEA2[3]	4.0	5.0	2.7	3.0	4.7	100	100	100	100	97	97	95	89	77*
Remington	4.5	4.8	2.7	3.0	3.7	100	100	100	100	97	97	93	86	75*
Linn (certified)	4.6	2.2	1.5	2.7	3.2	100	100	100	100	96	96	91	63	49
TetraSweet	4.3	4.0	3.2	3.8	5.5	100	100	100	100	94	94	68	53	42
PayDay	4.6	3.8	3.8	3.0	4.8	100	100	100	100	93	93	78	50	37
TetraMag	4.8	3.5	4.5	4.7	5.0	100	100	99	99	89	89	40	27	28
Mean	4.4	3.9	3.1	3.4	4.5	100	100	100	100	94	94	78	61	51
CV,%	8.3	16.6	28.4	16.5	29.2	0	0	1	1	3	3	14	27	24
LSD,0.05	0.4	0.8	1.0	0.7	1.6	0	0	1	1	4	4	13	20	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: 2020-8 days, 2021-14 days, 2022-16 days, 2023-15 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 11. Seedling vigor, grazing preference, and stand persistence of perennial ryegrass varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 2, 2020	Grazing Preference[2]			Percent Stand						
		2021	2022	2023	2020	2021		2022		2023	
		Apr 26	May 6	May 4	Oct 2	Mar 29	Oct 7	Mar 24	Oct 24	Mar 21	Oct 18
Commercial Varieties-Available for Farm Use											
Remington PLUS NEA23	4.1	5.3	4.3	5.5	100	100	100	100	100	100	99*
Remington	3.9	5.0	4.0	5.8	100	100	100	100	100	100	98*
PayDay	4.1	4.7	4.7	6.5	100	100	100	100	96	88	73
Power	4.3	4.7	4.8	6.2	100	100	100	100	96	88	73
Linn (certified)	4.9	3.2	3.2	5.8	100	100	97	97	86	64	40
Experimental Varieties											
BARLPF237	3.9	5.2	4.2	5.5	100	100	100	100	100	100	96*
Mean	4.2	4.7	4.2	5.9	100	100	99	99	96	90	80
CV,%	9.3	10.2	16.3	11.1	0	0	1	1	2	9	12
LSD,0.05	0.5	0.6	0.8	0.8	0	0	1	1	3	10	12

[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, 2022-16 days, 2023-15 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 8, 2021, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 5, 2021	Grazing Preference[2]		Percent Stand				
		2022	2023	2021	2022		2023	
		May 6	May 4	Oct 5	Mar 24	Oct 24	Mar 21	Oct 17
Commercial Varieties-Available for Farm Use								
Remington PLUS NEA2[3]	4.3	5.0	5.7	100	100	100	100	100*
Remington	4.6	4.8	5.7	100	100	100	99	99*
PayDay	4.7	5.0	6.2	100	100	100	97	94*
Power	4.6	5.3	5.7	100	100	100	98	93*
Linn (certified)	4.9	4.8	3.7	100	98	96	94	88*
TetraMag	5.0	6.5	7.3	100	99	95	89	32
Experimental Varieties								
GPT14021AR1	4.0	6.2	5.5	100	97	93	90	80
Mean	4.6	5.4	5.7	100	99	98	95	84
CV,%	7.4	13.9	15.1	0	2	5	7	13
LSD,0.05	0.4	0.9	1.0	0	2	6	8	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: 2022-16 days, 2023-15 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 persistenceof perennial ryegrass and festulolium (FL) varieties sown September 9, 2022, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Sep 28, 2022	Grazing Preference[2] May 4, 2023	Percent Stand		
			2022	2023	
			Sep 28	Mar 21	Nov 9
Commercial Varieties-Available for Farm Use					
Linn (certified)	4.9	3.7	100	100	100*
PayDay	4.8	4.2	100	100	100*
Power	4.8	4.0	100	100	100*
Spring Green (FL)	4.9	4.2	100	100	100*
Sugarcrest (FL)	4.9	4.3	100	100	100*
TetraMag	5.0	4.0	100	100	100*
TetraSweet	4.9	4.0	100	100	100*
Experimental Varieties					
PST-2BUL19	4.8	4.2	100	100	100*
Mean	4.9	4.1	100	100	100
CV,%	3.1	14.7	0	0	0
LSD,0.05	0.2	0.7	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: 2023-15 days.
* 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
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
BARFA9125	free	Barenbrug USA
BAR BTR7 NEA1	novel	Barenbrug USA
BARFABTR7NEA23	novel	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
GTC16076/T10941	free	Univ. of GA
GTC16077/T10942	free	Univ. of GA
GTC16078/T10943	free	Univ. of GA
GTC16079/T10944	free	Univ. of GA
GTC16081/T11044	novel	Univ. of GA
KY 31-	free	KY Agric. Exp. Station
KYFA9611	free	KY Agric. Exp. Station
KYFA9732/AR584	novel	KY Agric. Exp. Station
RAD-ERFH82	free	Radix Research
RAD-GAN208	free	Radix Research
RAD-TF119	free	Radix Research
SETFN97	free	Smith Seed Services
SETFPC-5BK	free	Smith Seed Services

[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	
Barlegro	Barenbrug USA
Devour	Mountain View Seeds
HLR	Barenbrug USA
Intensiv	Barenbrug USA
Persist	Smith Seed Services
Persist II	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]	
BARDgLF84	Barenbrug USA
BARDgLF85	Barenbrug USA
BARDGLF94	Barenbrug USA
BARDGLF95	Barenbrug USA
BARDgLF98	Barenbrug USA
BARDgLF99	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	
Linn (certified)	Public
PayDay	Mountain View Seeds
Power	Ampac Seed Co.
Remington	Barenbrug USA
Remington PLUS NEA2[1]	Barenbrug USA
TetraMag	Mountain View Seeds
TetraSweet	Mountain View Seeds
Experimental Varieties[2]	
BARLPF237	Barenbrug USA
GPT14021AR1	Mountain View Seeds
PST-2BUL19	Pure Seed Testing

[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 2001-2023 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]	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean[4]
			4yr[5]	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	(#trials)
Advance MaxQ	novel	Pennington Seed						94															–
Armory	free	Barenbrug USA																			99	100	100(2)
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	100	100	98(13)
Bronson	free	Ampac Seed									98	98						100					99(3)
Bull	free	Caudill Seed													96			100	98	91			96(4)
Cajun II	free	Smith Seed Services										98				97	100	100	99	96	99	100	99(8)
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						–
Estancia Arkshield	novel	Mountain View Seeds																			100	100	100(2)
Evergraze	free	Bailey Seed & Grain																				100	–
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				100	99(3)
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	99		100	97(17)
Jesup MaxQII	novel	Pennington Seed																			100		–
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	100	100(20)
KY31-	free	KY Agri. Exp Sta.	98	103	98	100	83	101	100	98	99	99	100	100	99	100	100	100	99	96	100	100	99(20)
Lacefield MaxQ II	novel	Pennington Seed					82	102	99	98	98	97			100	99	100	100	99	100	100	100	98(14)
Maximize	free	Rose Agri-Seed	99																				–
Ranchero	free	Smith Seed Services																	98		96	100	98(3)
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	96	100	100	99(7)
Stargrazer	free	Southern States	89																				–
STF43	free	Barenbrug USA																			97	100	99(2)
Stockman	free	Seed Res. of OR				102																	–
Texoma MaxQ II	novel	Pennington Seed					88	100	98												95		95(4)
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 the fall of 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 2000-2023 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]	2001	2002	2003	2004	2005[3]	2007	2009	2010	2011	2012	2013[3]	2014	2015	2016	2017	2018	2019	2020	Mean[4]
		4yr[5]	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	(#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				115	130(2)
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)
HLR	Barenbrug USA																		90	108	99(2)
Intensiv	Barenbrug USA				51															96	74(2)
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	132	140	115	115(12)
Persist II	Smith Seed Services																		117	115	116(2)
Potomac (certified)	Public			116		119									109	82	109				107(5)
Prairie	Turner Seed	127	121								94		131	90	97	107	60	105	90	113	100(10)
Prodigy	Caudill Seed												109	119		94	109	97	87		101(5)
Profile	Scott Seed			116																	–
Profit	Ampac Seed								95	99	102	94	95	90	82					107	96(7)
Swante	Smith Seed Services																			81	–
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	109	87		113(6)
Swante	Smith Seed Services																	57			–

[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 the fall of 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 2001-2023 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	2001[1,2]	2003	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean[3]
			3yr[4]	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	(#trials)
AGRLP103	–	AgResearch USA		86														–
Albion	tetraploid	Grassland Oregon										112						–
Aries	diploid	Ampac Seed	128															–
Barfest (FL)	MF x PR[6]	Barenbrug USA					116	112										114(2)
BG-34	diploid	Barenbrug USA										78						–
Boost	tetraploid	Allied Seed				101	83	95	92									93(4)
Calibra	tetraploid	DLF International							106		88	90	98		94			95(5)
Citadel	tetraploid	Donley Seed																–
Duo (FL)	MF x PR[6]	Ampac Seed				95	72	90	102			65	65					82(6)
Lasso	diploid	DLF-Jenks	120															–
Linn (certified)	diploid	Public	118	63		95	108	95	91	96	80	69	88	79	99	96	52	88(14)
Melpetra	tetraploid	Hood River Seed											90					–
PayDay	tetraploid	Mountain View Seeds								101	85			99	90	73	95	91(6)
Polly II	tetraploid	FS Growmark	63															52(2)
Power	tetraploid	Ampac Seed			158		107	112	96	89	79	78					95	102(8)
Quartet	tetraploid	Ampac Seed	70		59													68(2)
Remington	tetraploid	Barenbrug USA		151							138	168	169	124	116	147	128	143(8)
Remington PLUS NEA2[5]	tetraploid	Barenbrug USA									145	159			122	151	129	141(5)
Spring Green (FL)	MF x PR[6]	Rose Agri-Seed				109	115	115	106			81	88					102(6)
TetraGain	tetraploid	Pure Seed							102					90				96(2)
TetraMag	tetraploid	Mountain View Seeds													89	55		72(2)
TetraSweet	tetraploid	Mountain View Seeds													89	82		86(2)
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 the fall of 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.

Notes

Notes

2023 Cool-Season Grass Grazing Tolerance Report

Mention or display of a trademark, proprietary product, or firm in text or figures does not constitute an endorsement and does not imply approval to the exclusion of other suitable products or firms.

The College of Agriculture, Food and Environment is an Equal Opportunity Organization.
12-2023