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2021 Tall Fescue, Bromegrass, and Meadow Fescue Report

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Introduction

Tall fescue (*Festuca arundinacea*) is a productive, well-adapted, persistent, soil-conserving, cool-season grass grown on approximately 5.5 million acres in Kentucky. This grass, used for both hay and pasture, is the forage base of most of Kentucky's livestock enterprises, particularly beef cattle.

Much tall fescue in Kentucky is infected with an internal fungus (endophyte) that produces ergot alkaloids and results in decreased weight gains in growing ruminants and lower pregnancy rates in breeding stock, especially in hot weather. Varieties are now available that are free of this fungal endophyte or contain a nontoxic endophyte. Varieties in the latter group are also referred to as "novel" or "friendly" endophyte varieties, because their endophyte improves stand survival without creating animal production problems.

Smooth bromegrass (*Bromus inermis*) is a perennial pasture and hay grass native to Europe. Smooth bromegrass has creeping underground stems or rootstocks from which the leafy stems arise. This grass is palatable to all classes of livestock, from emergence to the heading stage. Meadow bromegrass (*Bromus biebersteinii*) is a native of southeastern Europe and the adjacent Near East. It resembles smooth bromegrass but has only short rhizomes or none at all. Meadow bromegrass is densely tufted, has a similar growth habit to tall fescue, and has the advantage of greater seedling vigor than smooth bromegrass. Hybrid bromegrass is a cross between smooth and meadow bromegrasses that combines the vigorous growth of smooth bromegrass with the leafiness and good regrowth of meadow bromegrass. Alaska bromegrass (*Bromus sitchensis*), also called Sitka bromegrass, is a long-lived perennial bunchgrass that grows at moderate rates during the spring and summer season. It does not spread by rhizomes and is more suited to environments with harsh winters.

Prairie bromegrass (*Bromus wildenowii*) is a tall, cool-season, leafy, short-lived, perennial, deep-rooted bunchgrass. It was introduced from South America. Seedheads are produced throughout the growing season. To maintain productive stands for several years, it is necessary to manage at least one growth cycle each year for seed production and natural reseeding. Some prairie bromegrasses are susceptible to winterkill. Mountain bromegrass (*Bromus marginatus*) is native to North America from Alaska to northern Mexico, where it can be found in many different habitats. It is a short-lived, perennial, cool-season, sod-forming grass. Mountain bromegrass' leafy growth and deep, well-branched root system give erosion protection on sloping ground. It is similar to California bromegrass (*Bromus carinatus*), and some consider them to be synonymous. Compared to tall fescue, the bromegrasses retain quality better as they mature and grow better during dry weather. However they are generally less well adapted to Kentucky conditions.

Meadow fescue (*Festuca pratensis*) is a semibunch type cool season European grass that has great winter hardiness. It will yield slightly less than tall fescue and orchardgrass, but has better digestability and palatability for grazing applications.

This report provides Kentucky yield trial data on varieties of tall fescue and similar grass species as well as guidelines for selecting tall fescue varieties. 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 a large number of other forage publications.

Important Selection Considerations

Local adaptation and seasonal yield. Select a variety that is well adapted to Kentucky, as indicated by good performance across years and locations in replicated yield trials such as those presented in this publication. Choose high-yielding persistent varieties and varieties that are productive during the desired season of use.

Tall fescues are often classified as either "Mediterranean" or "continental" types according to the area from which the parental material for the variety originated. In general, the Mediterranean types (e.g., cajun and fawn) are more productive in the fall and winter than the continental types (such as Kentucky 31). Compared to continental types, Mediterranean types mature earlier in spring and become dormant and nonproductive during the summer in Kentucky. They are also more susceptible to leaf diseases such as helminthsporium and rhizoctonia. Therefore, Mediterranean varieties are less preferred for use in Kentucky than continental types. Because Mediterranean varieties mature earlier in the spring, first-cutting yields are generally higher when the two types are harvested at the same time. However, the continental types produce more in the summer.

Endophyte level. Seed with infection levels of less than 5 percent is regarded as endophyte-free. A statement to that effect will be displayed prominently on a green tag attached to the seed bag. If no tag is present, assume the seed is infected with the toxic endophyte. Several varieties, both with and without the endophyte, are adapted for use in Kentucky. With the new "novel endophyte" tall fescues, the seed tag should specify the infection level. Seed of novel tall fescues should be handled carefully to preserve this infection, which means keeping seed cool and planting as soon as possible. Novel endophyte varieties need a high infection level to improve stand survival. Look for Alliance for Grassland Renewal seed-quality assurance printed on each bag of novel fescue seed.

Seed quality. Buy premium-quality seed that is high in germination and purity levels and free from weed seed. Buy certified seed of improved varieties. An improved variety is one that has performed well in independent trials. Please check label for the test date (which must be within the previous nine months), the level of germination, and the amount 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

Data from ten studies are reported. Tall fescue varieties were sown at Lexington (2018, 2019, and 2020), Princeton (2019) and Quicksand (2018). Bromegrass varieites were sown in Lexington in 2018, 2019, and 2020. Meadow fescue varieties were sown in Lexington in 2019 and 2020. The soils at Lexington (Maury), Princeton (Crider), and Quicksand (Nolin) are well-drained silt loams and are well suited for tall fescue and bromegrass production.

Seedings were made at the rate of 25 pounds per acre for tall fescue and meadow fescue and 20 pounds per acre for bromegrass into a prepared seedbed with a disk drill. Plots were 5 feet by 20 feet in a randomized complete block design with four replications with a harvested plot area of 5 feet by 15 feet. Nitrogen was topdressed at 60 pounds per acre of actual nitrogen in March, after the first cutting, and again in late summer, for a total of 180 pounds per acre over the season. The tests were harvested using a sickle-type forage plot harvester to simulate a spring cut hay/summer grazing/fall stockpile management system. The first cutting was harvested when all tall fescue and bromegrass varieties were at the boot stage or later. Fresh weight samples were taken at each harvest to calculate dry matter production. Management practices for these tests regarding establishment, fertility (P, K, and lime based on regular soil tests), weed control, and harvest timing were in accordance with University of Kentucky recommendations.

Results and Discussion

Weather data for Lexington, Quicksand, and Princeton are presented in tables 1 through 3. Ratings for maturity (see Table 4 for maturity scale), stand, and dry matter yields (tons/A) are reported in tables 5 through 14. Yields are given by cutting date for 2021 and as total annual production for all years of the trial. Stated yields are adjusted for percent weeds, therefore the tonnage given is for crop only. Varieties are listed by total yield in descending order. Experimental varieties are listed separately at the bottom of the tables.

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

	2019				2020				2021[2]			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	33	+2	4.11	+1.25	40	+9	3.72	+0.86	34	+3	4.51	+1.65
FEB	42	+7	7.64	+4.43	38	+3	5.14	+1.93	31	-4	4.60	+1.39
MAR	43	-1	3.49	-0.91	51	+7	3.79	-0.61	50	+6	5.12	+0.72
APR	54	+4	4.76	+0.88	52	-3	4.92	+1.04	54	-1	2.72	-1.16
MAY	69	+5	4.49	+0.02	62	-2	5.69	+1.22	62	-2	4.34	-0.13
JUN	73	+1	6.13	+2.47	72	0	2.56	-1.10	73	+1	6.26	+2.60
JUL	79	+3	3.30	-1.70	79	+3	3.23	-1.77	75	-1	5.90	+0.90
AUG	77	+2	2.42	-1.51	75	0	3.41	-0.52	76	+1	6.16	+2.23
SEP	77	+9	0.18	-3.02	68	0	4.43	+0.83	69	+1	3.03	-0.17
OCT	61	+4	7.55	+5.58	57	0	4.98	+2.41	62	+5	3.68	-1.11
NOV	41	-4	5.39	+2.00	49	+4	2.18	-1.21				
DEC	43	+7	5.74	+1.76	36	0	2.27	-1.71				
Total			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.

Table 2. Temperature and rainfall at Princeton, Kentucky, in 2020 and 2021.

	2020				2021[2]			
	Temp		Rainfall		Temp		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP
JAN	40	+6	4.27	+0.47	38	+4	5.02	+1.22
FEB	40	+2	6.80	+2.37	32	-6	3.64	-0.79
MAR	52	+5	6.63	+1.69	52	+5	5.35	+0.41
APR	54	-5	3.08	-1.72	56	-3	4.73	-0.07
MAY	64	-3	5.48	+0.52	64	-3	4.52	-0.64
JUN	74	-1	5.13	+1.28	75	0	6.89	+3.04
JUL	79	+1	6.31	+2.02	77	-1	7.03	+2.74
AUG	75	-2	3.77	-0.24	77	0	3.08	-0.93
SEP	69	-2	4.93	+1.60	70	-1	2.59	-0.74
OCT	57	-2	7.45	+4.40	65	+6	7.01	-1.04
NOV	51	+4	2.36	-2.27				
DEC	39	0	2.84	-2.20				
Total			59.05	+7.92			44.66	+3.02

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

Table 3. Temperature and rainfall at Quicksand, Kentucky, in 2019, 2020, and 2021.

	2019				2020				2021[2]			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	37	+6	4.93	+1.64	42	+11	3.32	+0.03	36	+5	3.39	+0.10
FEB	45	+12	8.15	+4.55	41	+8	7.11	+3.51	35	+2	6.91	+3.31
MAR	44	+3	2.15	-2.19	52	+11	7.96	+3.62	50	+9	5.78	+1.44
APR	58	+5	2.55	-1.55	53	0	4.93	+0.83	54	+1	2.79	-1.31
MAY	68	+6	3.91	-0.57	62	0	5.75	+1.27	62	0	2.00	-2.48
JUN	72	+2	8.35	+4.53	71	+1	4.54	+0.72	72	+2	4.23	+0.41
JUL	77	+3	6.32	+1.07	78	+4	4.26	-0.99	75	+1	7.04	+1.79
AUG	75	+2	1.57	-2.44	75	+2	6.56	+2.55	76	+3	8.38	+4.37
SEP	74	+8	0.04	-3.48	69	+3	4.40	+0.88	69	+3	1.72	-1.80
OCT	60	+6	6.80	+3.89	59	+5	3.55	+0.64	62	+8	2.30	-0.61
NOV	42	0	5.48	+1.60	49	+7	2.81	-1.07				
DEC	43	+10	6.15	+2.01	38	+5	4.82	+0.68				
Total			56.40	+9.06			60.01	+12.67			44.54	+5.22

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

Statistical analyses were performed on all data to determine if the apparent differences are truly due to varietal differences or just to chance. To determine if two varieties are truly different, compare the difference between them and the LSD (least significant difference) at the bottom of the column.

Table 4. Descriptive scheme for the stages of development in perennial forage grasses.

Code	Description	Remarks
	Leaf development	
11	First leaf unfolded	Applicable to regrowth of established (plants) and to primary growth of seedlings.
12	2 leaves unfolded	Further subdivision by means of leaf development index (see text).
13	3 leaves unfolded	
•	•••••	
19	9 or more leaves unfolded	
	Sheath elongation	
20	No elongated sheath	Denotes first phase of new spring growth after overwintering. This character is used instead of tillering which is difficult to record in established stands.
21	1 elongated sheath	
22	2 elongated sheaths	
23	3 elongated sheaths	
•	•••••	
29	9 or more elongated sheaths	
	Tillering (alternative to sheath elongation)	
21	Main shoot only	Applicable to primary growth of seedlingsor to single tiller transplants.
22	Main shoot and 1 tiller	
23	Main shoot and 2 tillers	
24	Main shoot and 3 tillers	
•	•••••	
29	Main shoot and 9 or more tillers	
	Stem elongation	
31	First node palpable	More precisely an accumulation of nodes. Fertile and sterile tillers distinguishable.
32	Second node palpable	
33	Third node palpable	
34	Fourth node palpable	
35	Fifth node palpable	
37	Flag leaf just visible	
39	Flag leaf ligule/collar just visible	
	Booting	
45	Boot swollen	
	Inflorescence emergence	
50	Upper 1 to 2 cm of inflorescence visible	
52	¼ of inflorescence emerged	
54	½ of inflorescence emerged	
56	¾ of inflorescence emerged	
58	Base of inflorescence just visible	
	Anthesis	
60	Preanthesis	Inflorescence-bearing internode is visible. No anthers are visible.
62	Beginning of anthesis	First anthers appear.
64	Maximum anthesis	Maximum pollen shedding.
66	End of anthesis	No more pollen shedding.
	Seed ripening	
75	Endosperm milky	Inflorescence green.
85	Endosperm soft doughy	No seeds loosening when inflorescence is hit on palm.
87	Endosperm hard doughy	Inflorescence losing chlorophyll; a few seeds loosening when inflorescence hit on palm
91	Endosperm hard	Inflorescence-bearing internode losing chlorophyll; seeds loosening in quantitywhen inflorescence hit on palm.
93	Endosperm hard and dry	Final stage of seed development; most seeds shed.

Source: J. Allan Smith and Virgil W. Hayes. 14th International Grasslands Conference Proc. p. 416-418. June 14-24, 1981, Lexington, Kentucky.

If the difference is equal to or greater than the LSD, the varieties are truly different when grown under the conditions at the given locations. The coefficient of variation (CV) is a measure of the variability of the data and is included for each column of means. Low variability is desirable, and increased variability within a study results in higher CVs and larger LSDs.

Tables 15, 16, and 17 show information about proprietors/distributors for all varieties studied in this report. Varieties are listed in alphabetical order by species, with the experimental varieties at the bottom. Remember that experimental varieties are not available for farm use; commercial varieties can be purchased from agricultural distributors. Remember to consider the relative spring maturity and the distribution of yield across the growing season when evaluating productivity of tall fescue and bromegrass varieties.

How to interpret the summary tables

Summaries of yield data from 2004 to 2021 for tall fescue and from 2006 to 2021 for bromegrass commercial varieties are presented in tables 18 and 19, respectively. The value for each variety in these tables is listed as a percentage of the mean of the commercial varieties entered in each specific trial. Varieties with percentages over 100 yielded better than average and varieties with percentages less than 100 yielded lower than average. Direct statistical comparisons of varieties cannot be made using the Table 18 and 19 summaries, but these comparisons can help to identify varieties for further consideration. Varieties that have performed better than average over many years and at several locations have very stable performance, while others may have performed very well in wet years or on particular soil types. These details may influence variety choice, and more information from past years can be found in the appropriate annual reports. See the footnotes in Tables 18 and 19 to determine the yearly report that should be referenced.

Summary

Selecting a good variety of tall fescue and bromegrass is an important first step in establishing a productive stand of grass. Proper management, beginning with seedbed preparation and continuing throughout the life of the stand, is necessary for even the highest-yielding variety to produce to its genetic potential.

For more information, consult the following University of Kentucky Cooperative Extension publications related to tall fescue management. These resources are available from your county Extension office and may be accessed in the "Publications" section of the UK Forage website (https://forages.ca.uky.edu).

- Lime and Fertilizer Recommendations (AGR-1)
- Grain and Forage Crop Guide for Kentucky (AGR-18)
- Tall Fescue (AGR-59)
- Establishing Forage Crops (AGR-64)
- Tall Fescue in Kentucky (AGR-108)
- Forage Identification and Use Guide (AGR-175)
- Rotational Grazing (ID-143)

About the Authors

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Table 5. Dry matter yields, seedling vigor, maturity, and stand persistence of tall fescue and festuloium (FL) varieties sown September 4, 2018, at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Sep 28, 2018	Maturity[3] 2019 May 6	Maturity[3] 2020 May 4	Maturity[3] 2021 May 11	Percent Stand 2018 Sep 28	Percent Stand 2019 Mar 22	Percent Stand 2019 Oct 17	Percent Stand 2020 Mar 17	Percent Stand 2020 Oct 27	Percent Stand 2021 Mar 24	Percent Stand 2021 Oct 22	Yield (tons/acre) 2019 Total	Yield (tons/acre) 2020 Total	Yield (tons/acre) 2021 May 11	Yield (tons/acre) 2021 Jun 17	Yield (tons/acre) 2021 Oct 18	Yield (tons/acre) 2021 Total	3-year Total
Commercial Varieties-Available for Farm Use																			
Cajun II	free	4.9	56.5	53.0	56.5	100	100	100	100	100	100	100	3.37	3.87	1.73	1.05	1.39	4.17	11.41*
KY31+	toxic	4.9	55.5	50.5	53.0	100	100	100	100	100	100	100	3.23	3.66	1.54	1.19	1.50	4.23	11.12*
Lacefield MaxQII	novel	4.4	55.5	54.0	53.5	100	100	100	100	100	100	100	3.07	3.65	1.67	1.00	1.59	4.27	10.98*
Estancia Arkshield	novel	4.3	56.5	54.0	55.5	100	100	100	100	100	100	100	3.15	3.47	1.67	1.15	1.48	4.29	10.91*
Jesup MaxQ	novel	4.8	56.5	53.0	55.5	100	100	100	100	100	100	100	2.95	3.56	1.77	0.94	1.31	4.02	10.53*
Bull	free	4.5	57.5	54.5	56.5	100	100	100	100	100	100	100	3.15	3.39	1.60	0.90	1.38	3.89	10.43*
BarOptima PLUS E34	novel	4.8	52.0	51.5	51.5	100	100	100	100	100	100	100	2.60	3.73	1.13	0.84	1.54	3.51	9.84*
SS0705TFSL	free	4.8	56.5	53.5	55.0	100	100	100	100	100	100	100	2.69	3.65	1.29	0.82	1.29	3.40	9.74*
Kentucky 32	free	4.9	56.0	54.5	56.0	100	100	100	100	100	100	100	2.65	2.88	1.12	0.73	1.26	3.11	8.65
Experimental Varieties																			
KYFA9304	free	4.9	55.0	52.5	53.5	100	100	100	100	100	100	100	3.19	3.94	1.69	0.82	1.73	4.24	11.38*
KYFA1704	free	4.8	54.0	50.5	53.5	100	100	100	100	99	99	99	2.72	3.53	1.75	0.98	1.36	4.10	10.35*
KYFA9821/AR584	novel	4.8	56.0	52.0	53.0	100	100	100	100	100	100	100	3.04	3.41	1.37	0.96	1.49	3.82	10.27*
B-18.1787	free	4.5	57.5	52.5	56.0	100	100	100	100	100	100	100	2.99	3.71	1.21	0.89	1.40	3.50	10.21*
KY31-	free	5.0	55.0	50.5	54.5	100	100	100	100	100	100	100	2.95	3.73	1.34	0.85	1.32	3.51	10.19*
FTF2(FL)	free	4.8	56.5	52.5	55.5	100	100	100	100	100	100	100	2.88	3.57	1.45	0.96	1.20	3.60	10.05*
BARFAF131	free	3.4	55.0	53.0	52.8	100	100	100	100	100	100	100	2.59	3.47	1.53	0.73	1.36	3.62	9.68*
BARFAF137	free	4.5	51.5	51.5	46.8	100	100	100	100	100	100	100	3.05	3.17	1.41	0.80	1.19	3.40	9.61*
FTF89	free	4.9	57.0	53.5	55.5	100	100	100	100	100	100	100	2.65	3.36	1.70	0.60	1.28	3.59	9.59*.
BARFAF135	free	4.9	53.0	50.0	46.3	100	100	100	100	100	100	100	2.87	3.33	1.34	0.68	1.36	3.38	9.58*
7FACF82	free	5.0	51.0	50.5	48.0	100	100	100	100	100	100	100	2.62	3.11	1.36	1.04	1.35	3.74	9.47*
KYFA9611	free	4.6	52.0	50.0	47.5	100	100	100	100	100	100	100	2.83	3.40	0.97	0.65	1.35	2.97	9.19
7016	free	4.9	56.0	52.0	54.0	100	100	100	100	100	100	100	2.70	3.01	1.46	0.74	1.24	3.44	9.16
BARFABTR7 NEA23	novel	3.9	54.0	53.5	54.0	100	100	100	100	100	100	100	2.50	3.22	1.31	0.75	1.33	3.40	9.12
RADMRF20	free	4.8	54.5	54.0	53.5	100	100	100	100	100	100	100	2.49	3.03	1.43	0.84	1.30	3.57	9.09
BARFA6BR-179	novel	4.3	50.5	51.5	51.8	100	99	99	98	98	99	72	2.26	2.85	1.32	0.96	1.25	3.52	8.63
SLTF10-3	free	4.6	54.5	54.5	54.5	100	100	100	100	100	100	100	2.09	2.91	1.14	1.15	1.17	3.46	8.45
Mean		4.6	54.8	52.4	53.2	100	100	100	100	100	100	99	2.82	3.41	1.44	0.89	1.36	3.68	9.91
CV,%		6.2	2.0	3.0	4.2	0	0	0	1	1	1	9	18.22	17.06	22.75	39.81	17.26	19.60	15.63
LSD,0.05		0.4	1.6	2.2	3.1	0	1	1	1	1	1	12	0.72	0.82	0.46	0.50	0.33	1.02	2.18

[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] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Dry matter yields, seedling vigor, maturity, and stand persistence of tall fescue varieties sown August 30, 2019, at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 23, 2019	Maturity[3] 2020	Maturity[3] 2021	Percent Stand 2019	Percent Stand 2020		Percent Stand 2021		Yield (tons/acre) 2020	Yield (tons/acre) 2021				2-year Total
			May 4	May 11	Oct 23	Mar 17	Oct 27	Mar 24	Oct 22	Total	May 11	Jun 17	Oct 19	Total	
Commercial Varieties-Available for Farm Use															
SS0705TFSL	free	3.8	50.3	55.0	100	100	100	100	100	3.80	1.93	1.17	1.35	4.45	8.25*
Lacefield MaxQII	novel	4.0	51.5	56.0	100	100	100	100	100	3.63	2.27	1.05	1.23	4.55	8.18*
Greendale Protek	novel	4.4	46.3	50.3	100	100	100	100	100	3.48	2.18	1.09	1.30	4.57	8.05*
Tower	free	4.4	45.0	47.3	100	100	100	100	100	3.47	1.84	1.32	1.39	4.55	8.03*
Greendale	free	3.9	46.3	48.5	100	100	100	100	100	3.47	1.90	1.28	1.32	4.49	7.97*
Texoma MaxQII	novel	3.3	48.5	55.5	100	99	99	99	99	3.34	2.37	0.89	1.27	4.53	7.87*
Bronson	free	3.9	53.0	56.0	100	100	100	100	99	3.58	2.21	0.87	1.20	4.28	7.86*
Tower Protek	novel	4.0	45.0	45.0	100	100	100	100	100	3.24	2.09	1.28	1.24	4.60	7.84*
Martin 2 Protek	novel	4.3	52.5	55.5	100	100	100	100	98	3.56	1.88	1.12	1.25	4.25	7.82*
BarOptima PLUS E34	novel	3.8	46.3	50.3	100	100	100	100	100	3.33	2.15	0.99	1.28	4.42	7.75*
Ranchero	free	4.1	53.0	55.5	100	100	100	100	100	3.46	2.00	0.96	1.13	4.10	7.56*
BARFASTF-43	free	3.8	46.3	48.5	100	100	100	100	100	3.21	1.84	1.04	1.44	4.31	7.52*
Jesup MaxQII	novel	3.0	48.5	55.0	100	100	100	100	100	2.97	2.16	0.90	1.49	4.54	7.51*
Kentucky 32	free	2.1	53.0	56.0	96	96	94	94	94	2.72	2.22	1.23	1.22	4.68	7.40*
Estancia Arkshield	novel	3.1	49.8	54.5	100	100	100	100	100	3.02	1.78	1.26	1.24	4.28	7.30*
Armory	free	2.6	49.3	54.5	100	100	100	100	100	2.94	2.08	0.88	1.37	4.33	7.27*
Cajun II	free	3.5	51.5	56.0	100	100	100	100	100	3.10	2.05	0.96	1.13	4.14	7.24*
DLFPS-FTF 100 Protek	novel	4.1	51.5	54.5	100	100	100	100	100	3.24	1.84	0.96	1.14	3.94	7.18*
Triumphant Protek	novel	3.4	52.0	55.5	100	100	100	100	100	3.07	1.96	0.98	1.13	4.07	7.14*
Triumphant	free	3.9	52.0	57.0	100	100	100	100	100	3.13	1.85	1.13	0.97	3.95	7.08
Velvet	free	3.6	46.8	52.5	100	100	100	100	99	2.52	1.94	1.17	1.13	4.24	6.76
Kokanee	free	3.8	45.0	38.3	100	100	100	100	98	2.91	1.38	1.04	0.92	3.34	6.25
KY31+	toxic	4.3	49.8	55.0	100	100	100	100	96	3.52	1.31	0.52	0.37	2.20	5.72
Experimental Varieties															
KYFA9611	free	3.9	45.0	45.0	100	100	100	100	100	3.97	1.50	1.12	1.23	3.85	7.82*
PPG-FTF116	free	3.9	52.5	56.5	100	100	100	100	100	3.26	2.05	1.13	1.38	4.56	7.82*
DLFPS-TF89	free	3.6	52.0	56.0	100	100	100	100	99	3.16	2.17	1.08	1.16	4.41	7.57*
KY31-	free	4.3	50.5	53.5	100	100	100	100	100	3.36	2.04	1.00	1.00	4.04	7.40*
PPG-FTF111	free	3.8	49.0	57.0	100	100	100	100	100	3.09	1.86	1.06	1.36	4.28	7.38*
SETFN97	free	2.9	51.0	54.5	100	100	100	100	100	2.82	2.21	1.00	1.21	4.42	7.24*
GA95101T	free	3.8	46.3	55.0	100	100	100	100	100	2.32	2.02	0.86	1.25	4.13	6.45
GA29	free	2.3	49.0	56.0	95	88	95	98	98	2.25	1.96	1.21	0.97	4.14	6.39
BARFA9125	free	2.0	45.0	45.0	100	98	98	93	93	3.04	1.48	0.97	0.79	3.23	6.27
Mean		3.6	49.2	52.9	100	99	100	99	99	3.19	1.95	1.05	1.18	4.18	7.37
CV,%		19.8	4.7	4.3	2	4	2	2	2	15.67	17.43	24.97	18.01	12.00	10.85
LSD,0.05		1.0	3.3	3.2	3	5	3	3	3	0.70	0.48	0.37	0.30	0.71	1.12

[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] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.

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

Table 7. Dry matter yields, seedling vigor, maturity, and stand persistence of tall fescue varieties sown August 28, 2020, at Lexington, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Sep 24, 2020	Maturity[3] 2021 May 7	Percent Stand			Yield (tons/acre)			
				2020	2021		2021			
				Sep 24	Mar 24	Oct 22	May 7	Jun 16	Oct 20	Total
Commercial Varieties-Available for Farm Use										
Ranchero	free	3.6	53.5	100	100	100	2.49	1.81	1.65	5.95*
Jesup MaxQ	novel	4.1	53.5	100	100	100	3.05	1.35	1.53	5.93*
SS0705TFSL	free	4.4	50.8	100	100	100	2.41	1.69	1.62	5.72*
BarOptima PLUS E34	novel	3.8	47.5	100	100	100	2.63	1.55	1.49	5.67*
Texoma MaxQII	novel	3.5	53.5	100	100	100	2.57	1.45	1.64	5.66*
Fillmore(FTF70)	free	4.1	49.8	100	100	100	2.32	1.64	1.63	5.59*
Cajun II	free	4.1	55.5	100	100	100	2.45	1.53	1.59	5.57*
Triumphant Protek	novel	3.8	53.0	100	100	100	2.54	1.51	1.52	5.56*
Greendale Protek	novel	4.1	48.0	100	100	100	2.54	1.59	1.43	5.56*
Armory	free	3.4	51.3	100	100	100	2.27	1.73	1.46	5.46*
Palatine	free	3.9	53.5	100	100	100	2.40	1.46	1.58	5.44*
Martin 2 Protek	novel	3.6	55.5	100	100	100	2.60	1.46	1.37	5.44*
Lacefield MaxQII	novel	3.4	52.5	100	100	100	2.43	1.37	1.60	5.41*
Estancia Arkshield	novel	3.6	54.0	100	100	100	2.19	1.67	1.50	5.37*
STF43	free	3.4	45.0	100	100	100	2.17	1.38	1.62	5.17*
KY31+	toxic	3.6	52.0	100	100	100	2.09	1.51	1.44	5.04*
Tower Protek	novel	3.6	45.0	100	100	100	2.08	1.54	1.41	5.03
Experimental Varieties										
KY31-	free	4.3	50.8	100	100	100	2.77	1.79	1.73	6.29*
B-18.1790	free	3.5	56.0	100	100	100	2.60	1.73	1.59	5.93*
B-18.1788	free	3.1	57.5	100	100	100	2.51	1.67	1.71	5.89*
FTF120	free	4.3	53.5	100	100	100	2.69	1.56	1.46	5.71*
KYFA9611	free	4.0	45.0	100	100	100	2.29	1.82	1.49	5.60*
SETFN97	free	3.4	51.8	100	100	100	2.36	1.57	1.58	5.51*
FTF100 Protek	novel	4.1	53.5	100	100	100	2.08	1.97	1.45	5.49*
FTF117	free	3.5	54.5	100	100	100	2.23	1.70	1.49	5.42*
BARBTR7NEA23	novel	3.0	49.8	100	100	100	2.58	1.32	1.50	5.41*
BARBTR7NEA21	novel	2.6	48.0	99	100	100	1.97	1.72	1.61	5.30*
B-18.1789	free	3.9	57.5	100	100	100	2.31	1.37	1.46	5.14*
BARFAF137	free	2.9	46.3	100	100	100	2.08	1.42	1.53	5.02
GALA16029	free	3.3	52.3	100	100	100	2.35	1.18	1.45	4.98
BAR9301BTR1	novel	3.4	46.8	100	100	100	1.86	1.52	1.58	4.96
RAD-ERFH82	free	3.4	46.3	100	100	100	2.06	1.32	1.47	4.86
BARFA6BTR179	novel	3.4	45.0	100	100	100	1.81	1.43	1.42	4.66
BARFAF135	free	3.0	46.8	100	100	100	1.78	1.20	1.42	4.40
Mean		3.6	51.0	100	100	100	2.34	1.55	1.53	5.42
CV,%		14.7	4.5	0	0	0	22.54	18.54	15.70	16.45
LSD,0.05		0.7	3.2	1	0	0	0.74	0.40	0.34	1.75

[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] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.

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

Table 8. Dry matter yields, seedling vigor, and stand persistence of tall fescue varieties sown September 6, 2019, at Princeton, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Nov 4, 2019	Percent Stand					Yield (tons/acre)						
			2019	2020		2021		2020	2021					2-year
			Nov 4	Mar 12	Nov 11	Apr 6	Oct 26	Total	May 11	Jun 16	Aug 25	Oct 23	Total	Total
Commercial Varieties-Available for Farm Use														
Greendale Protek	novel	5.0	100	98	97	97	94	4.96	2.06	1.44	0.75	0.47	4.72	9.68*
Greendale	free	4.8	100	99	98	98	98	4.52	2.38	1.35	0.46	0.46	4.64	9.17*
Cajun II	free	5.0	100	100	100	100	99	4.40	2.31	1.53	0.31	0.39	4.54	8.98*
KY31+	toxic	4.9	100	98	99	87	71	4.29	2.35	1.27	0.54	0.47	4.63	8.73*
Ranchero	free	4.4	100	93	93	93	87	4.45	2.08	1.13	0.33	0.38	3.92	8.73*
BarOptima PLUS E34	novel	5.0	100	97	98	89	83	4.96	1.56	1.38	0.39	0.34	3.68	8.65*
Martin 2 Protek	novel	5.0	100	98	97	97	94	3.59	2.38	1.32	0.68	0.24	4.62	8.21*
Estancia Arkshield	novel	4.8	100	96	96	98	94	4.53	1.56	1.28	0.42	0.33	3.58	8.11*
Tower	free	4.5	100	84	91	91	91	4.52	1.80	1.01	0.35	0.33	3.49	8.01*
Tower Protek	novel	4.9	100	91	93	93	78	4.62	1.68	1.17	0.20	0.17	3.21	7.94*
Triumphant	free	4.9	100	78	82	82	77	3.78	1.97	1.12	0.39	0.53	4.02	7.81*
Triumphant Protek	novel	5.0	100	88	91	91	90	3.86	2.15	1.26	0.26	0.26	3.94	7.80*
Armory	free	4.3	100	65	74	62	61	3.74	1.97	1.13	0.16	0.07	3.35	7.77*
DLFPS-FTF100 Protek	novel	4.8	100	93	93	85	79	3.87	2.23	0.95	0.39	0.36	3.92	6.83
STF-43	free	5.0	100	86	88	88	78	3.76	1.52	1.26	0.14	0.13	3.05	6.82
Experimental Varieties														
PPG-FTF116	free	4.9	100	91	91	93	90	4.01	2.48	1.46	0.49	0.31	4.74	8.75*
KY31-	free	5.0	100	96	96	96	89	4.16	1.91	1.38	0.45	0.27	4.01	8.17*
DLFPS-TF89	free	4.6	100	98	98	74	74	4.02	1.88	1.01	0.76	0.30	3.95	7.63*
SETFN97	free	4.6	100	71	84	84	59	3.80	2.22	1.01	0.36	0.13	3.71	7.62*
PPG-FTF111	free	4.4	100	90	95	96	96	2.96	2.18	1.17	0.33	0.43	4.11	7.48*
KYFA9611	free	4.8	100	92	81	74	68	3.51	1.76	1.17	0.35	0.18	3.39	7.24*
BARFA9125	free	4.6	100	88	87	85	53	2.75	1.25	1.17	0.38	0.02	2.81	5.56
Mean		4.8	100	91	92	89	82	4.06	1.99	1.23	0.41	0.30	3.94	8.05
CV,%		7.1	0	13	10	14	20	18.81	28.59	35.04	70.12	73.49	30.30	19.39
LSD,0.05		0.5	0	19	15	18	23	1.19	0.81	0.61	0.42	0.32	1.74	2.49

[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 9. Dry matter yields, seedling vigor, and stand persistence of tall fescue and festulolium (FL) varieties sown September 7, 2018, at Quicksand, Kentucky.

Variety	Endophyte Status[1]	Seedling Vigor[2] Oct 5, 2018	Percent Stand							Yield (tons/acre)						
			2018	2019		2020		2021		2019	2020	2021				3-year Total
			Oct 5	Mar 15	Oct 23	Mar 26	Nov 9	Apr 16	Oct 12	Total	Total	May 12	Jul 19	Sep 24	Total	
Commercial Varieties-Available for Farm Use																
KY31+	toxic	4.9	100	100	100	100	100	99	99	3.48	4.54	0.89	0.89	0.33	2.11	10.13*
Jesup MaxQ	novel	4.1	100	100	100	100	100	100	100	3.33	4.02	0.75	1.41	0.40	2.56	9.92*
SS0705TFSL	free	4.1	100	100	96	100	98	98	98	3.11	3.11	1.44	1.54	0.66	3.64	9.86*
Cajun II	free	4.5	100	100	100	100	98	96	94	3.11	3.96	0.82	1.44	0.49	2.74	9.81*
Lacefield MaxQII	novel	4.4	100	100	98	98	98	98	98	3.10	3.06	1.14	1.32	0.39	2.85	9.01
BarOptima PLUS E34	novel	4.0	100	100	91	93	84	79	85	2.59	2.72	0.96	1.18	0.59	2.73	8.04
Experimental Varieties																
KYFA9821/AR584	novel	4.5	100	100	99	100	100	99	99	4.49	4.38	0.99	1.00	0.28	2.27	11.14*
KYFA9611	free	4.6	100	100	99	99	97	89	94	3.87	4.48	1.12	0.95	0.34	2.42	10.77*
B-18.1787	free	4.0	100	100	100	100	100	98	98	4.07	4.04	1.20	1.02	0.31	2.53	10.65*
BARFAF131	free	3.5	94	99	96	99	99	96	97	3.38	4.33	1.29	0.89	0.34	2.51	10.22*
KYFA9304	free	4.8	100	100	100	100	100	99	99	3.68	4.46	0.88	0.74	0.29	1.90	10.05*
KY31-	free	4.6	99	100	100	99	98	98	98	3.31	3.99	1.10	1.18	0.45	2.72	10.02*
FTF89	free	4.9	100	100	100	100	100	100	100	3.33	3.60	1.26	1.05	0.37	2.67	9.60*
KYFA1704	free	5.0	100	100	100	100	98	96	96	2.95	4.15	0.94	0.85	0.18	1.96	9.07
7016	free	4.4	100	100	99	99	99	98	98	3.15	3.13	1.06	1.11	0.26	2.43	8.70
FTF2(FL)	free	4.0	98	100	96	97	94	95	93	2.52	3.34	1.19	0.90	0.50	2.59	8.46
BARFAF137	free	4.6	100	100	94	92	82	84	82	2.61	2.89	1.07	1.02	0.25	2.34	8.20
BARFABTR7 NEA23	novel	4.0	100	88	87	87	87	87	87	1.74	3.06	1.14	1.38	0.64	3.16	7.96
RADMRF20	free	4.8	100	100	100	100	100	100	100	2.04	2.37	1.51	1.22	0.42	3.16	7.57
7FACF82	free	4.6	100	100	67	81	81	80	69	2.05	2.04	1.49	1.45	0.40	3.34	7.43
BARFA6BR-179	novel	3.9	100	97	65	74	61	59	60	2.74	2.54	0.76	0.88	0.18	1.82	7.10
BARFAF135	free	4.6	100	100	95	95	93	88	89	1.84	1.98	1.44	1.30	0.31	3.06	6.88
Mean		4.4	100	99	94	96	94	93	92	3.02	3.46	1.11	1.13	0.38	2.62	9.13
CV,%		11.5	2	5	14	10	13	12	10	27.72	28.86	35.16	49.98	59.54	39.45	14.82
LSD,0.05		0.7	3	8	18	13	14	15	13	1.18	1.41	0.56	0.80	0.32	1.47	1.93

[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 10. Dry matter yields, seedling vigor, maturity, and stand persistence of bromegrass varieties sown September 5, 2018, at Lexington, Kentucky.

Variety	Type	Seedling Vigor[1]	Maturity[2]						Percent Stand							Yield (tons/acre)							
			2019		2020		2021		2018	2019		2020		2021		2019	2020	2021					3-year
		Sep 28, 2018	May 2	Jun 6	May 6	Jun 17	May 6	Jun 14	Sep 28	Mar 22	Oct 18	Mar 17	Oct 27	Mar 24	Oct 22	Total	Total	May 6	Jun 14	Aug 25	Oct 18	Total	Total
Commercial Varieties-Available for Farm Use																							
Arsenal	meadow	3.9	57.5	29.0	56.5	29.0	56.5	66.0	94	97	97	97	95	95	58	4.05	3.75	1.29	0.89	0.83	0.24	3.26	11.06*
Peak	smooth	4.6	49.0	29.0	45.0	29.0	49.6	66.0	98	98	98	97	98	98	85	3.96	3.35	1.22	1.14	0.70	0.38	3.44	10.74*
Admiral	meadow	4.3	56.0	29.0	56.5	57.0	57.0	66.0	96	98	98	98	98	98	55	4.04	3.46	0.83	1.15	0.67	0.27	2.93	10.43*
Macbeth	meadow	3.4	55.0	60.0	56.5	58.5	56.0	66.0	92	97	97	97	97	97	63	3.83	3.48	1.15	0.84	0.77	0.33	3.09	10.40*
Artillery	smooth	4.8	46.3	29.0	46.3	29.0	48.5	29.0	97	98	98	98	98	99	90	3.78	3.27	1.23	0.95	0.68	0.48	3.34	10.39*
Carlton	smooth	4.0	45.0	60.0	45.0	60.0	52.7	66.0	95	95	97	95	95	95	70	2.85	2.64	1.13	1.46	0.52	0.27	3.38	8.86
Mean		4.2	51.6	38.0	51.0	42.5	53.3	59.8	95	97	98	97	97	97	71	3.80	3.36	1.15	1.06	0.70	0.33	3.24	10.39
CV,%		14.1	3.6	0.0	1.8	2.2	5.3	0.0	3	2	1	2	2	2	20	8.37	14.42	38.16	25.67	27.78	28.58	16.96	6.76
LSD,0.05		0.9	2.8	0.0	1.4	1.4	4.3	0.0	4	3	2	3	2	2	22	0.48	0.64	0.67	0.40	0.30	0.15	0.84	1.07

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 11. Dry matter yields, seedling vigor, maturity, and stand persistence of bromegrass varieties sown August 30, 2019, at Lexington, Kentucky.

Variety	Type	Seedling Vigor[1]	Maturity[2]			Percent Stand					Yield (tons/acre)						
			2020		2021	2019	2020		2021		2020	2021					2-year
		Nov 1, 2019	May 7	Jun 17	May 6	Nov 1	Mar 17	Oct 27	Mar 24	Oct 22	Total	May 6	Jun 14	Aug 25	Oct 19	Total	Total
Commercial Varieties-Available for Farm Use																	
Arsenal	meadow	5.0	56.5	60.0	57.5	99	97	96	96	88	3.66	2.13	1.26	1.02	0.60	5.01	8.68*
Admiral	meadow	4.3	55.5	60.0	57.0	98	98	98	98	80	4.02	1.72	1.04	0.97	0.55	4.29	8.31*
Artillery	smooth	5.0	50.3	29.0	45.0	100	98	98	98	95	3.75	2.13	0.96	0.75	0.56	4.41	8.16*
MacBeth	meadow	3.9	54.5	60.0	57.0	94	87	90	90	88	3.21	1.69	1.21	0.95	0.53	4.38	7.60*
Experimental Varieties																	
MB1302	meadow	4.3	56.0	60.0	56.0	99	99	97	97	88	3.48	1.47	1.18	1.00	0.55	4.20	7.67*
Mean		4.5	54.6	53.8	54.5	98	96	96	96	87	3.62	1.83	1.13	0.94	0.56	4.46	8.08
CV,%		9.2	4.1	0.0	1.4	3	7	5	5	14	13.53	21.06	23.21	32.04	23.25	10.78	10.48
LSD,0.05		0.6	3.4	0.0	1.2	5	10	8	7	18	0.76	0.59	0.40	0.46	0.20	0.74	1.30

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 12. Dry matter yields, seedling vigor, maturity, and stand persistence of bromegrass varieties sown August 28, 2020, at Lexington, Kentucky.

Variety	Type	Seedling Vigor[1] Sep 24, 2020	Maturity[2] 2021 Apr 30	Percent Stand 2020 Sep 24	Percent Stand 2021 Mar 24	Percent Stand 2021 Oct 22	Yield (tons/acre) 2021 Apr 30	Yield (tons/acre) 2021 Jun 14	Yield (tons/acre) 2021 Aug 25	Yield (tons/acre) 2021 Oct 20	Yield (tons/acre) 2021 Total
Commercial Varieties-Available for Farm Use											
Arsenal	meadow	3.0	56.0	100	100	100	2.34	1.57	1.26	0.54	5.71*
Macbeth	meadow	3.5	55.5	100	100	100	2.58	1.30	1.18	0.59	5.65*
Admiral	meadow	3.6	56.0	100	100	100	2.50	1.26	1.14	0.56	5.46*
Peak	smooth	4.1	46.3	100	100	100	2.23	1.43	0.72	0.52	4.91*
Artillery	meadow	4.0	45.0	100	100	100	1.73	1.33	0.68	0.43	4.16
Experimental Varieties											
MB1302	meadow	3.4	55.0	100	100	100	2.32	1.29	1.02	0.54	5.17*
Mean		3.6	52.3	100	100	100	2.28	1.36	1.00	0.53	5.18
CV,%		18.9	2.5	1.0	0.0	0.0	22.38	22.58	26.52	21.59	19.15
LSD,0.05		1.0	1.9	1.0	0.0	0.0	0.81	0.46	0.40	0.17	1.49

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 13. Dry matter yields, seedling vigor, maturity, and stand persistence of meadow fescue varieties sown August 30, 2019, at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 27, 2019	Maturity[2] 2020 May 7	Maturity[2] 2021 May 13	Percent Stand 2019 Oct 27	Percent Stand 2020 Mar 17	Percent Stand 2020 Oct 26	Percent Stand 2021 Mar 24	Percent Stand 2021 Oct 22	Yield (tons/acre) 2020 Total	Yield (tons/acre) 2021 May 13	Yield (tons/acre) 2021 Jun 17	Yield (tons/acre) 2021 Aug 25	Yield (tons/acre) 2021 Oct 19	Yield (tons/acre) 2021 Total	2-year Total
Commercial Varieties-Available for Farm Use															
Pradel	5.0	46.3	46.3	100	100	98	98	96	3.79	1.95	0.81	1.01	0.68	4.45	8.25*
BARFP HDR	4.3	46.3	46.3	100	100	100	99	99	3.58	1.53	0.84	0.61	0.72	3.70	7.28*
Experimental Varieties															
KYFP1301	4.8	47.5	47.5	100	100	100	99	98	3.71	1.39	0.74	0.79	0.57	3.50	7.20*
Mean	4.7	46.7	46.7	100	100	99	98	98	3.69	1.62	0.80	0.80	0.66	3.88	7.58
CV,%	8.0	6.9	5.9	0	1	1	1	1	13.53	30.73	19.75	19.23	8.73	10.73	8.16
LSD,0.05	0.6	5.6	4.8	0	1	2	2	2	0.86	0.86	0.27	0.27	0.10	0.72	1.07

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 14. Dry matter yields, seedling vigor, maturity, and stand persistence of meadow fescue varieties sown August 28, 2020, at Lexington, Kentucky.

Variety	Seedling Vigor[1] Sep 24, 2020	Maturity[2] 2021 May 13	Percent Stand 2020 Sep 24	Percent Stand 2021 Mar 24	Percent Stand 2021 Oct 22	Yield (tons/acre) 2021 May 13	Yield (tons/acre) 2021 Jun 17	Yield (tons/acre) 2021 Aug 25	Yield (tons/acre) 2021 Oct 20	Yield (tons/acre) 2021 Total
Commercial Varieties-Available for Farm Use										
Raskila	4.0	45.0	100	100	100	2.55	1.17	0.90	0.65	5.27*
BARFP HDR	3.9	48.8	100	100	100	2.51	1.08	0.62	0.67	4.87*
Pradel	4.8	49.3	100	99	98	2.09	0.92	0.78	0.61	4.40
Experimental Varieties										
KYFF1301	4.3	50.0	100	100	100	2.02	1.08	0.83	0.63	4.55
Mean	4.2	48.3	100	100	99	2.29	1.06	0.78	0.64	4.77
CV,%	11.9	4.4	0	1	1	12.74	19.74	20.14	11.26	8.32
LSD,0.05	0.8	3.4	0	2	2	0.47	0.34	0.25	0.12	0.64

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37=flag leaf emergence, 45=boot swollen, 50=beginning of inflorescence emergence, 58=complete emergence of inflorescence, 62=beginning of pollen shed. See Table 4 for complete scale.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 15. Proprietors of tall fescue varieties in current trials.

Variety	Endophyte Status[1]	Proprietor/KY distributor
Commercial Varieties-Available for Farm Use		
Armory	free	Barenbrug USA
BarOptima PLUS E34	novel	Barenbrug USA
Bronson	free	Ampac Seed
Bull	free	Improved Forages
Cajun II	free	Smith Seed Services
DLFPS-FTF100 Protek	novel	DLF-Pickseed
Estancia Arkshield	novel	Mountain View Seeds
Fillmore(FTF70)	free	DLF-Pickseed
Greendale	free	DLF-Pickseed
Greendale Protek	novel	DLF-Pickseed
Kentucky 32	free	Oregro Seeds
Kokanee	free	Smith Seed Services
KY31+	toxic	Ky Agric. Exp. Station/Public
Jesup MaxQ	novel	Pennington Seed
Jesup MaxQII	novel	Pennington Seed
Lacefield MaxQ II	novel	Pennington Seed
Martin 2 Protek	novel	DLF-Pickseed
Palatine	free	Mountain View Seeds
Ranchero	free	Smith Seed Services
SS-0705TFSL	free	Southern States
STF43	free	Barenbrug USA
Texoma MaxQII	novel	DLF-Pickseed
Tower	free	DLF-Pickseed
Tower Protek	novel	DLF-Pickseed
Triumphant	free	DLF-Pickseed
Triumphant Protek	novel	DLF-Pickseed
Velvet	free	Oregro Seeds
Experimental Varieties[1]		
BARBTR7NEA21	novel	Barenbrug USA
BARFABTR7NEA23	novel	Barenbrug USA
BARFAF131	free	Barenbrug USA
BARFAF135	free	Barenbrug USA
BARFAF137	free	Barenbrug USA
BARFA6BTR179	novel	Barenbrug USA
BARFA9125	free	Barenbrug USA
BAR9301BTR1	novel	Barenbrug USA
B-18.1787	free	Blue Moon Farms
B-18.1788	free	Blue Moon Farms
B-18,1789	free	Blue Moon Farms
B-18.1790	free	Blue Moon Farms
DLFPS-TF-89	free	DLF-Pickseed
FTF89	free	DLF-Pickseed
FTF100 Protek	novel	DLF-Pickseed
FTF117	free	DLF-Pickseed
FTF120	free	DLF-Pickseed
GA29	free	Univ. of Georgia
GA95101T	free	Univ. of Georgia
GALA16029	free	Univ. of Georgia
KY31-	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
PPG-FTF 111	free	Mountain View Seeds
PPG-FTF 116	free	Mountain View Seeds
RAD-ERFH82	free	Radix Research
RADMRF20	free	Radix Research
SETFN97	free	Smith Seed Services
SLTF10-3	free	Oregro Seeds
7016	free	KY Agric. Exp. Station
7FACF82	free	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 bromegrass varieties in current trials.

Variety	Type	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use		
Admiral	meadow	Cisco Seeds
Arsenal	meadow	Barenbrug USA
Artillery	meadow	Barenbrug USA
Carlton	smooth	Pickseed USA
MacBeth	meadow	Cisco Seeds
Peak	smooth	Allied Seed
Experimental Varieties[1]		
MB1302	meadow	Allied Seed

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

Table 17. Proprietors of meadow fescue varieties in current trials.

Variety	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use	
BARFP HDR	Barenbrug USA
Pradel	Barenbrug USA
Raskila	Columbia Seeds
Experimental Varieties[1]	
KYFF1301	Ky Agric. Exp. Station

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

Table 18. Summary of Kentucky tall fescue yield trials 2005-2021 (yield shown as a percentage of the mean of the commercial varieties in the trial).

Variety	Endophyte Status[1]	Proprietor	Lexington																			Quicksand				Mean[4] (#trials)
			05[2,3] 3-yr[5]	07 3-yr	09 3-yr	11 3-yr	12 3-yr	13 3-yr	14 3-yr	15 3-yr	16 3-yr	17 3-yr	18 3-yr	19 2-yr	06 3-yr	08 3-yr	10 3-yr	12 3-yr	15 2-yr	17 3-yr	19 2-yr	05 4-yr	13 3-yr	16 3-yr	18 3-yr	
Atlas Select	free	ProSeeds Marketing														95										–
Aprilia	free	ProSeeds Marketing														93										–
Armory	free	Barenbrug USA												97							95					–
Baguala	free	Allied Seed								92									96							94(2)
BarElite	free	Barenbrug USA		96		100											92									95(3)
BARFASTF-43	free	Barenbrug USA												101							83					92(2)
Bariane	free	Barenbrug USA	99																			95				94(3)
Barolex	free	Barenbrug USA	90																							–
BarOptima PLUS E34	novel	Barenbrug USA	122	99		107	108	102	99	113	99	90	95	104			99	100	96	105	105		93	118	85	102(19)
Bronson	free	Ampac Seed	88	97	105	102	99	99			100			105			101	91	103			102				99(11)
Brutus	free	Saddle Butte Ag. Inc.							90																	–
Bull	free	Improved Forages	102				100						100					99					95			99(7)
Cajun II	free	Smith Seed Services				97		105	99	99	98	107	109	97			101		104	91	109		90	96	104	100(15)
Cowgirl	free	Rose-AgriSeeds					94									102	100	98								99(4)
DLFPS-FTF 100 Protek	novel	DLF Pickseed												96							83					90(2)
Dominate	free	Allied Seed								90									99							95(2)
Drover	free	Barenbrug USA							105	120																113(2)
DuraMax GOLD	novel	DLF Pickseed				102									106											104(2)
Enhance	free	Allied Seed				93																				–
Estancia ArkShield	novel	Mountain View Seeds					106				96		105	98				102			99			103		101(7)
Flourish	free	Allied Seed					92											101								97(2)
FSG 402TF	free	Farm Science Genetics								92									103							98(2)
Goliath	free	Ampac Seed			100			104									99									101(3)
Greendale	free	DLF Pickseed												107							112					110(2)
Greendale Protek	novel	DLF Pickseed												108							118					113(2)
HyMark	free	Fraser Seeds				91				104						102			103							100(4)
Jesup EF	free	Pennington Seed				98	105										103	100								102(4)
Jesup MaxQ	novel	Pennington Seed	98	101	110	103	100	93	106	102	111	104	101			95	100	98	98	103		102	100	116	105	103(20)
Jesup MaxQII	novel	Pennington Seed												101												
Kentucky 32	free	Oregro Seeds				93	94		101				83	99		98	94	101								96(6)
Kokanee	free	Smith Seed Services												84												
Kora Protek	novel	DLF Pickseed									101													86		94(2)
KY31+	toxic	KY Agric Exp Sta.	108	102	102	93	95	103	100	99	103	101	107	77	104	93	112	101	92	105	106	110	110	110	107	102(23)
Lacefield MaxQ II	novel	Pennington Seed		109				97	104	93	92	94	106	110	101	106			105	100			113	102	95	101(14)
Martin2 Protek	novel	DLF Pickseed				104					96			105							100			106		102(5)
Nanryo	free	Jap. Grassland ForageSeed/		96																						–
Noria	free	ProSeeds Marketing		98																						–
Payload	free	Brett Young									89													111		100(2)
RAD-ERF50	free	Radix Research, Inc.														113										–
Ranchero	free	Smith Seed Services										92		101						96	106					99(4)
Savory	free	DLF Pickseed													91											–
Select	free	Southern States	99	99	98	90	100	97	103	97	102				102	105	99	100	99			91	99	86		92(17)
SS-0705TFSL	free	Southern States							99	99	106	111	94	111					103	101				101	104	101(9)
Stockman	free	Seed Research of OR													97											–
Teton II	free	Mountain View Seeds				107	105		96		103							99						91		100(6)

continued

Table 18. continued.

Variety	Endophyte Status[1]	Proprietor	Lexington																		Quicksand				Mean[4] (#trials)
			05[2,3]	07	09	11	12	13	14	15	16	17	18	19	06	08	10	12	15	17	19	05	13	16	18	
			3-yr[5]	3-yr	3-yr	3-yr	3-yr	3-yr	3-yr	3-yr	3-yr	3-yr	3-yr	2-yr	3-yr	3-yr	3-yr	3-yr	2-yr	3-yr	2-yr	4-yr	3-yr	3-yr	3-yr	
Texoma MaxQ II	novel	Pennington Seed	95											106												–
TF0203G	free	Seed Research of OR		87																						–
Tower	free	DLF Pickseed									101			108							97			91		99(4)
Tower Protek	novel	DLF Pickseed				98					104			105							97			81		97(5)
Triumphant	free	DLF Pickseed												95							95					95(2)
Triumphant Protek	novel	DLF Pickseed												96							95					96(2)
Tuscany II	free	Seed Research of OR					97								98			106								–
Velvet	free	Oregro Seeds												91												–
5CAN	free	Brett Young			86																					–

[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 forage yield between varieties. To find actual yields, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in 2016 was harvested two years, so the final report would be "2019 Tall Fescue 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 19. Summary of Kentucky bromegrass yield trials at Lexington 2006-2021 (yield shown as a percentage of the mean of the commercial varieties in the trial).

Variety	Type	Proprietor/KY Distributor	2006[1,2] 4-yr[4]	2008 3-yr	2010 3-yr	2012 3-yr	2014 3-yr	2015 3-yr	2016 4-yr	2017 3-yr	2018 3-yr	2019 2-yr	Mean[3] (#trials)
AC Knowles	hybrid	Agriculture Canada	85		82	102	89						89(4)
Admiral	meadow	Cisco Seeds							107	106	100	101	104(4)
Arid	meadow	Mountain View Seeds							94	93			94(2)
Arsenal	meadow	Barenbrug USA									106	106	106(2)
Artillery	smooth	Barenbrug USA									100	100	100(2)
Bigfoot	hybrid	Grassland Oregon	108	116	105								110(3)
Canterbury	mountain	Barenbrug USA		79									–
Carlton	smooth	Pickseed USA				82	95				85		87(3)
Doina	smooth	Barenbrug USA		114	108								111(2)
Fleet	meadow	Agriculture Canada	110			109							110(2)
Hakari	Alaska	Barenbrug USA		85	85								85(2)
MacBeth	meadow	Cisco Seeds		136	119	107	116	107	103	123	100	93	112(9)
Olga	smooth	Barenbrug USA		116	101								109(2()
Peak	smooth	Allied Seed		97		100		93	95	88	103		96(6)
Persister	prairie	DLF Pickseed		72									–
RAD-BI29	smooth	Columbia Seeds	96	86									91(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 forage yield between varieties. To find actual yields, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in 2012 was harvested three years, so the final report would be "2015 Tall Fescue and Brome Report" archived in the UK Forage website (https://forages.ca.uky.edu).
[3] Mean only presented when respective variety was included in two or more trials.
[4] Number of years of data.

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