

# 2013 Annual and Perennial Ryegrass and Festulolium Report

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## Introduction

Annual ryegrass (*Lolium multiflorum*) and perennial ryegrass (*Lolium perenne*) are high-quality, productive cool-season grasses used in Kentucky. Both have exceptionally high seedling vigor and are highly palatable to livestock.

Annual ryegrasses are increasing in use across Kentucky as more winter-hardy varieties are released and promoted. Annual ryegrass is productive for three to four months and is used primarily for late fall and early to late spring pasture. Winter growth occurs only during mild winters. This crop has garnered increased interest for high quality baleage. Two main types of annual ryegrasses are used. The most commonly used type in Kentucky is Italian ryegrass. The other is sometimes referred to as Westerwolds ryegrass. The Westerwolds type is a true annual, in that stands seeded in the spring produce seedheads that summer, and little regrowth occurs after seedheads are produced. Westerwolds ryegrass varieties are commonly used in the lower South (Florida to Texas) because they can be seeded in the fall and will survive the winter. In Kentucky, winter survival can be an issue for Westerwolds varieties, so before planting one of these varieties, review winter survival results for Kentucky.

Italian ryegrass is native to Southern Europe and is not a true annual. In Kentucky most varieties behave as biennials or short-lived perennials, depending on environmental conditions. Italian ryegrasses provide high yields of quality forage and show quick regrowth. If planted in the spring, no or few seedheads will grow that summer (vernalization is required). Spring planting of Italian ryegrass is common in northern states (e.g., Wisconsin, Minnesota, etc.) for

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

	2011				2012				2013 <sup>2</sup>			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP <sup>1</sup>	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	29	-2	2.10	-0.76	38	+7	4.80	+1.94	38	+7	4.50	+1.64
FEB	39	+4	6.34	+3.13	40	+5	5.39	+2.18	36	+1	1.78	-1.43
MAR	47	+3	4.76	+0.36	56	+12	5.64	+1.24	39	-5	5.47	+1.07
APR	58	+3	12.36	+8.48	56	+1	3.26	-0.62	55	0	4.46	+0.58
MAY	64	0	6.72	+2.25	69	+5	4.02	-0.45	65	+1	5.23	+0.76
JUN	74	+2	2.61	-1.05	73	+1	2.42	-1.24	72	0	7.32	+3.66
JUL	80	+4	6.29	1.29	81	+5	2.50	-2.50	72	-4	9.33	+4.33
AUG	75	0	2.89	-1.04	75	0	1.68	-2.25	72	-3	3.68	-0.25
SEP	66	-2	5.52	+2.32	67	-1	6.40	+3.20	67	-1	2.21	-0.99
OCT	55	-2	4.10	+1.53	55	-2	2.00	-0.57	55	-2	8.10	+5.53
NOV	50	+5	9.53	+6.14	43	-2	1.81	-0.65				
DEC	41	+5	5.58	+1.60	42	+6	9.57	+4.94				
Total			68.80	+24.25			49.49	+4.94			52.08	+14.90

<sup>1</sup> DEP is departure from the long-term average.

<sup>2</sup> 2013 data is for the ten months through October.

summer grazing, but most current varieties do not dependably survive Kentucky summers. Italian ryegrasses are almost always planted late summer to early fall in Kentucky and typically provide forage production into early summer.

Both forage and turf types of annual ryegrasses are available. Turf types are low growing and have poor yield. Turf types are also infected with a fungal endophyte that lives inside the plant, protecting it from insect attack but producing a toxin that reduces performance of grazing animals. All turf types are infected. Plant only forage-type varieties for grazing, hay, or silage.

Perennial ryegrass can be used as a short-lived hay or pasture plant and has growth characteristics similar to tall fescue. It is more persistent than Italian ryegrass but less persistent than other cool-season grass species. It tillers more profusely but is lower growing than Italian ryegrass and will not form a seedhead in the seeding year. Both diploid (two sets of chromosomes) and tetraploid (four sets of chromosomes) varieties of perennial ryegrass exist. Tetraploids

have larger tillers and seedheads and wider leaves. Tetraploid types tend to be taller and less dense than diploid types even in early stages of regrowth. Diploid types produce more tillers, have better stand persistence, and are more tolerant to heavy grazing.

Intermediate or hybrid ryegrass (*Lolium hybridum*, Hausska) is the result of a cross between Italian ryegrass and perennial ryegrass. It is not as winter hardy as perennial ryegrass, but it is higher yielding. It is also more persistent and winter hardy than Italian ryegrass. Its uses would be similar to those of perennial ryegrass.

Festuloliums are hybrids between various fescues and ryegrasses with higher quality than tall fescue and improved stand survival over perennial ryegrass. Their use in Kentucky is still limited since they do not survive as long as tall fescue.

This report provides current yield data on annual and perennial ryegrass varieties in trials in Kentucky as well as guidelines for selecting varieties. Tables 15, 16, and 17 show summaries of all annual and perennial ryegrass and fes-

tulolium varieties tested in Kentucky for the last 10-plus years. The UK Forage Extension Web site at [www.uky.edu/Ag/Forage](http://www.uky.edu/Ag/Forage) contains electronic versions of all forage variety testing reports from Kentucky and surrounding states and a large number of other forage publications.

## Important Selection Considerations

**Local adaptation and seasonal yield.** The variety should be adapted to Kentucky as indicated by good winter survival and good performance across years and locations in replicated yield trials, such as those presented in this publication. Choose high-yielding varieties, but choose varieties that are productive during the desired season of use.

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

Important: When seeding perennial ryegrasses for horse pasture (of any kind), insist on an endophyte-free variety. The endophyte level will be stated on a green tag on every bag of seed. Most forage types of perennial ryegrass are endophyte free, and most new turf types are infected. This endophyte is similar to the endophyte of tall fescue and produces alkaloids that are toxic to cattle and horses.

## Description of the Tests

Data from nine studies are reported. Annual ryegrass tests were established in the fall of 2010, 2011, and 2012 at Lexington. Perennial ryegrass tests were established in 2011 and 2012 and festulolium tests were established in 2010, 2011 and 2012 at Lexington. The soil at Lexington is a well-drained silt loam (Maury) and is well suited for ryegrass production.

Seedlings were made at the rate of 25 pounds per acre 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. For the perennial tests nitrogen was top-dressed at 60 pounds per acre of actual nitrogen in March, May, and August. For the annual tests nitrogen was top-dressed at 60 pounds per acre in March and after the first spring harvest. The tests were harvested using a sickle-type forage plot harvester. The first cutting was harvested at each location when all ryegrass varieties had reached at least the boot stage. Fresh weight samples were taken at each harvest to calculate dry matter production. Management practices for these tests regarding establishment, fertility, weed control, and harvest timing were in accordance with University of Kentucky recommendations.

**Table 2. Descriptive scheme for the stages of development in perennial forage grasses.**

Code	Description	Remarks
<b>Leaf development</b>		
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	
<b>Sheath elongation</b>		
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	
<b>Tillering (alternative to sheath elongation)</b>		
21	Main shoot only	Applicable to primary growth of seedlings or 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	
<b>Stem elongation</b>		
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	
<b>Booting</b>		
45	Boot swollen	
<b>Inflorescence emergence</b>		
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	
<b>Anthesis</b>		
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.
<b>Seed ripening</b>		
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 quantity when inflorescence hit on palm.
93	Endosperm hard and dry	Final stage of seed development; most seeds shed.

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

**Table 3. Dry matter yields, seedling vigor, maturity and stand persistence of annual ryegrass varieties sown September 6, 2010, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 14, 2010	Maturity <sup>2</sup>				Percent Stand					Yield (tons/acre)						
		2011				2010	2011				2011						
		Apr 21	May 19	Jun 7	Jun 28	Oct 14	Jan 5	Mar 16	Jul 13	Aug 23	Jan 5	Apr 21	May 19	Jun 7	Jun 28	Jul 22	Total
<b>Commercial Varieties—Available for Farm Use</b>																	
Barmultra II	3.0	33.3	41.8	53.5	62	99	100	100	100	83	0.16	1.99	1.36	1.01	0.38	0.13	5.03*
GR-AS10	4.0	32.5	39.0	52.0	62	100	100	100	100	58	0.20	1.76	1.12	0.80	0.25	0.11	4.25
Attain	3.6	33.0	49.8	59.0	62	100	100	100	99	0	0.36	1.95	1.07	0.63	0.17	0.00	4.18
Feast II	4.8	32.0	39.0	52.0	62	100	100	98	99	91	0.20	1.49	1.12	0.86	0.31	0.14	4.11
Fox	4.3	32.8	43.8	53.5	62	100	100	99	99	71	0.18	1.66	0.99	0.81	0.31	0.12	4.07
Winterhawk	3.4	33.3	49.8	57.5	62	100	100	100	100	0	0.28	1.91	0.96	0.56	0.22	0.01	3.93
TAMTBO	3.8	33.0	47.0	58.0	62	100	100	100	100	0	0.22	1.88	0.90	0.65	0.16	0.01	3.82
Marshall	4.3	33.0	51.3	56.5	62	100	100	100	100	0	0.39	1.64	0.99	0.58	0.17	0.00	3.77
Bruiser	4.3	33.5	48.8	60.5	62	100	100	100	100	3	0.40	1.85	0.87	0.49	0.14	0.00	3.76
Jackson	3.3	33.3	46.5	58.0	62	100	100	100	100	0	0.42	1.91	0.80	0.49	0.11	0.01	3.74
Big Boss	3.8	33.8	55.0	62.0	62	99	100	99	99	0	0.29	1.61	0.98	0.68	0.12	0.00	3.68
Ed	2.5	33.8	50.3	61.0	62	99	100	100	100	0	0.22	1.92	0.87	0.50	0.12	0.00	3.62
Fria	3.1	33.0	46.0	59.0	62	100	100	100	99	5	0.31	1.85	0.84	0.46	0.12	0.00	3.58
Brangus	4.0	32.3	55.5	60.5	62	100	100	99	99	0	0.29	1.42	1.02	0.57	0.24	0.01	3.56
Big Daddy	3.5	33.0	56.0	61.0	62	100	100	98	98	0	0.23	1.32	0.99	0.56	0.14	0.02	3.25
Verdure	4.3	32.5	56.0	62.0	62	100	100	99	99	1	0.32	1.31	0.93	0.54	0.12	0.01	3.23
KB Royal	4.3	32.8	54.0	59.0	62	100	100	100	100	1	0.35	1.31	0.86	0.47	0.12	0.01	3.12
Gulf	4.1	32.8	55.5	61.0	62	100	100	99	100	0	0.31	1.34	0.83	0.34	0.10	0.00	2.93
HS-1	4.6	32.0	56.0	60.0	62	100	100	97	96	0	0.25	1.13	0.86	0.41	0.07	0.00	2.72
<b>Experimental Varieties</b>																	
BAR LMF9881	3.0	33.5	41.8	54.0	62	100	100	100	100	48	0.20	2.17	1.20	0.92	0.31	0.12	4.91*
BAR LMF9876	2.6	33.0	43.8	56.0	62	98	100	100	100	13	0.16	2.05	1.09	0.75	0.26	0.08	4.39
PPG-LMT103	1.6	31.8	41.8	52.0	62	99	100	100	100	100	0.19	1.54	1.32	0.79	0.33	0.12	4.28
BAR LMF9740	3.4	33.5	43.5	56.0	62	100	100	98	98	6	0.20	1.75	1.13	0.81	0.25	0.02	4.16
B-7.1366	3.5	33.0	42.0	57.0	62	100	100	99	100	0	0.25	2.03	0.91	0.68	0.15	0.02	4.04
PPG-LMT102	2.0	33.8	49.3	56.0	62	98	100	100	100	0	0.17	1.70	0.89	0.58	0.17	0.01	3.51
Mean	3.6	33.0	48.1	57.5	62	100	100	99	99	19	0.26	1.70	1.00	0.64	0.19	0.04	3.83
CV,%	22.1	1.8	8.8	3.3	0	1	0	1	1	49	42.91	14.16	11.56	14.01	26.30	60.61	9.01
LSD,0.05	1.1	0.8	6.0	2.7	0	1	0	2	2	13	0.16	0.34	0.16	0.13	0.07	0.03	0.49

<sup>1</sup> Vigor score based on scale of 1 to 5 with 5 being the most vigorous seedling growth

<sup>2</sup> 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 2 for complete scale.

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

## Results and Discussion

Weather data for Lexington are presented in Table 1.

Ratings for maturity (see Table 2 for maturity scale) and dry matter yields (tons/A) are reported in tables 3 through 11. Yields are given by cutting date for 2013 and as total annual production. 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, listed separately at the bottom of the tables, are not available commercially.

In most years, annual ryegrasses can be expected to die or become unproductive after mid-June in their first summer. Unlike annual ryegrasses, perennials should be productive under Kentucky conditions for an average of two to three growing seasons.

Statistical analyses were performed on all data (including experimentals) to determine if the apparent differences are truly due to varietal differences or just due to chance. Varieties not significantly different from the top variety in the column are marked with one asterisk (\*). To determine if two varieties are truly different, compare the difference between them 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 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; increased variability within a study results in higher CVs and larger LSDs.

Tables 12, 13, and 14 summarize information about distributors and yield performance for all annual and perennial ryegrass and festulolium varieties cur-

rently included in tests discussed 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. In tables 12, 13, and 14, an open block indicates that the variety was not in that particular test (labeled at the top of the column); an “x” in the block means that the variety was in the test but yielded significantly less than the top-yielding variety. A single asterisk (\*) means that the variety was not significantly different from the top variety, based on the 0.05 LSD. It is best to choose a variety that has performed well over several years and locations. Remember to consider the relative spring maturity and the distribution of yield across the growing season when evaluating productivity of ryegrass varieties (tables 3 through 11).

**Table 4. Dry matter yields, seedling vigor, plant height, maturity and stand persistence of annual ryegrass varieties sown September 14, 2011, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 11, 2011	Percent Stand			Height (inches)			Maturity <sup>2</sup>			Yield (tons/acre)					
		2011		2012	2011		2012		2012			2011	2012			
		Oct 11	Mar 21	Jun 4	Dec 2	Apr 5	May 10	Apr 5	May 10	Jun 4	Dec 2	Apr 6	May 10	Jun 4	Total	
<b>Commercial Varieties—Available for Farm Use</b>																
Winterhawk	5.0	100	100	100	10	23	15	34	52	58	1.06	1.61	0.62	0.44	3.72*	
TAMTBO	2.8	100	100	100	10	20	18	34	54	59	0.92	1.45	0.68	0.41	3.46*	
Jackson	4.0	100	100	100	10	23	15	34	53	61	0.94	1.53	0.54	0.38	3.39*	
MX 108	3.5	100	100	100	9	19	16	33	48	56	0.75	1.44	0.72	0.44	3.35*	
Bruiser	4.5	100	100	100	10	24	16	34	54	59	0.98	1.47	0.54	0.33	3.32*	
Maximo	3.5	100	100	100	9	19	15	33	45	57	0.63	1.52	0.66	0.42	3.23	
Marshall	4.0	100	100	100	10	24	18	34	50	59	0.76	1.48	0.62	0.32	3.19	
Primecut	3.0	100	100	100	10	22	14	34	53	60	0.78	1.42	0.50	0.29	2.99	
TillageMax-Bristol	3.3	100	100	100	9	20	14	33	51	58	0.67	1.26	0.61	0.34	2.87	
TillageMax-INDY	3.3	100	100	100	10	22	15	33	50	60	0.63	1.37	0.48	0.38	2.85	
DH3	4.3	100	100	100	10	20	18	34	56	59	0.77	1.17	0.55	0.35	2.85	
AE110	2.6	100	100	100	9	21	17	33	48	58	0.56	1.38	0.61	0.29	2.84	
Fria	3.3	100	100	100	10	25	15	34	54	60	0.64	1.43	0.43	0.29	2.79	
Big Daddy	3.5	100	100	100	9	19	18	33	56	61	0.68	1.10	0.55	0.29	2.62	
TillageRootMax	3.8	100	100	100	10	19	14	33	49	58	0.74	1.01	0.54	0.32	2.61	
Feast II	2.0	100	100	100	8	15	13	33	46	59	0.44	1.10	0.55	0.48	2.57	
Gulf	3.8	100	100	100	10	22	16	34	56	59	0.63	1.17	0.41	0.22	2.43	
<b>Experimental Varieties</b>																
07-2 AR	3.5	100	100	100	10	22	15	33	46	61	0.79	1.76	0.72	0.49	3.76*	
PS-AR-09-1	3.0	100	100	100	9	20	16	33	45	61	0.74	1.39	0.70	0.48	3.32*	
PS-Lm-09-2	3.5	100	100	100	11	21	15	33	48	59	0.77	1.46	0.60	0.45	3.27*	
XLFLOLHY	4.3	100	100	100	10	18	17	34	52	58	0.91	1.27	0.69	0.37	3.23	
XLFDARG	2.0	100	100	100	6	20	12	33	51	60	0.28	1.47	0.52	0.43	2.70	
Mean	3.5	0	0	0	9.4	20.6	15.2	33.3	50.6	59.0	0.73	1.38	0.58	0.37	3.06	
CV,%	18.3	0	0	0	9.0	7.6	11.6	2.2	4.7	3.3	21.47	14.25	18.11	26.67	11.51	
LSD,0.05	0.9	0	0	0	1.2	2.2	2.5	1.1	3.4	2.8	0.22	0.28	0.15	0.14	0.50	

<sup>1</sup> Vigor score based on scale of 1 to 5 with 5 being the most vigorous seedling growth.

<sup>2</sup> 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 2 for complete scale.

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

Tables 15, 16, and 17 are summaries of yield data from 1999 to 2013 of commercial varieties that have been entered in the Kentucky trials. The data are listed as a percentage of the mean of the commercial varieties entered in each specific trial. In other words, the mean for each trial is 100 percent—varieties with percentages over 100 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 summary tables 15, 16, and 17, but these comparisons do help to identify varieties for further consideration. Varieties that have performed better than average over many years and at several locations have stable performance; others may have performed well in wet years or on particular soil types. These details may influence variety choice and the information can be found in the yearly reports. See the footnotes in tables 15, 16, and 17 to determine to which yearly report to refer.

## Summary

Selecting a good variety of annual or perennial ryegrass or festulolium 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.

The following is a list of University of Kentucky Cooperative Extension publications related to ryegrass management. They are available from your county Extension office and are listed in the “Publications” section of the UK Forage Web site, [www.uky.edu/Ag/Forage](http://www.uky.edu/Ag/Forage).

- Lime and Fertilizer Recommendations (AGR-1)
- Grain and Forage Crop Guide for Kentucky (AGR-18)

- Establishing Forage Crops (AGR-64)
- Forage Identification and Use Guide (AGR-175)
- Annual Ryegrass (AGR-179)
- New Recommendations for Perennial Ryegrass Seedings for Kentucky Horse Farms (ID-142)
- Rotational Grazing (ID-143)
- Establishing and Managing Horse Pastures (ID-147)

## Authors

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**Table 7. Dry matter yields, seedling vigor, maturity and stand persistence of perennial ryegrass varieties sown September 14, 2011, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 11, 2011	Maturity <sup>2</sup>		Percent Stand					Yield (tons/acre)						
		2012	2013	2011	2012		2013		2012	2013				2-year Total	
		May 4	May 24	Oct 11	Mar 21	Oct 23	Mar 20	Oct 21	Total	May 24	Jun 25	Aug 5	Oct 21		Total
<b>Commercial Varieties—Available for Farm Use</b>															
Kentaur	3.5	48.0	50.5	100	100	95	84	93	2.88	0.75	0.63	0.40	0.63	2.40	5.29*
Boost	4.8	54.5	56.8	100	100	93	88	92	2.98	1.17	0.31	0.34	0.45	2.27	5.24*
Power	3.3	53.0	56.5	100	100	96	91	94	2.65	0.83	0.51	0.36	0.48	2.18	4.83*
Calibra	3.8	48.8	54.5	100	100	97	95	97	2.49	0.70	0.48	0.34	0.44	1.96	4.45
Granddaddy	2.8	52.0	57.0	100	100	95	94	94	2.15	0.73	0.34	0.34	0.44	1.85	4.00
Linn	3.8	59.0	59.5	100	100	100	85	86	2.12	0.88	0.24	0.34	0.38	1.84	3.96
<b>Experimental Varieties</b>															
XLFTETPRG	4.3	55.0	56.5	100	100	94	86	91	3.12	1.21	0.30	0.37	0.41	2.29	5.41*
Mean	3.7	52.9	55.9	100	100	96	89	92	2.63	0.89	0.40	0.35	0.46	2.11	4.74
CV,%	11.9	3.0	4.3	0	0	2	9	5	14.71	22.98	16.48	27.69	20.85	13.87	12.90
LSD,0.05	0.7	2.4	5.6	0	0	3	12	7	0.57	0.31	0.10	0.12	0.14	0.44	0.91

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

<sup>2</sup> 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 2 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, maturity and stand persistence of perennial ryegrass and festulolium (FL) varieties sown September 7, 2012, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 15, 2012	Maturity <sup>2</sup>		Percent Stand			Yield (tons/acre)				
		2013	2012	2013		2013					
		May 20	Oct 15	Mar 20	Oct 22	May 20	Jun 28	Aug 6	Oct 24	Total	
<b>Commercial Varieties—Available for Farm Use</b>											
Perseus (FL)	4.3	54.5	100	100	98	3.51	1.52	0.46	0.72	6.21*	
LHT-102	4.8	54.0	100	100	100	3.36	1.39	0.43	0.71	5.89*	
Hostyn (FL)	3.0	58.5	99	100	100	3.09	1.42	0.51	0.70	5.72*	
Elena DS	3.3	54.5	98	98	98	3.17	1.20	0.32	0.55	5.24	
TetraGain	3.0	56.0	97	98	98	3.15	1.06	0.39	0.56	5.16	
Boost	3.0	56.0	91	99	95	3.04	0.93	0.29	0.61	4.87	
Crave	3.3	53.0	100	100	100	2.79	0.90	0.26	0.75	4.70	
Power	3.8	54.5	100	100	100	2.64	0.90	0.36	0.67	4.57	
Calibra	4.0	54.0	100	100	100	2.83	0.84	0.29	0.57	4.53	
Impressario	4.1	55.5	100	100	100	2.42	0.92	0.30	0.87	4.51	
Verseka	3.6	55.0	100	100	100	2.76	0.86	0.30	0.44	4.35	
Granddaddy	3.3	56.5	99	99	100	2.64	0.77	0.27	0.65	4.33	
BG34	4.4	50.3	100	100	100	2.27	0.78	0.24	0.70	4.00	
Linn	3.3	58.5	100	100	100	2.33	0.52	0.21	0.57	3.62	
<b>Experimental Varieties</b>											
PPG-LHT 104	4.6	52.5	100	100	100	3.33	1.30	0.40	0.66	5.69*	
PPG-FPRT 105	2.9	53.5	100	100	100	2.73	1.00	0.31	0.69	4.72	
IS-FLPT 5	3.4	53.0	100	100	100	2.58	1.01	0.32	0.80	4.71	
IS-FLPT 6	3.0	52.5	100	100	100	2.45	0.93	0.31	0.74	4.43	
PPG-FPRD 104	3.9	57.0	100	100	100	2.65	0.70	0.29	0.62	4.25	
IS-FLPD 6	3.6	55.0	100	100	99	2.17	0.74	0.21	0.54	3.66	
Mean	3.6	54.7	99	100	99	2.79	0.98	0.32	0.66	4.76	
CV,%	19.1	3.2	3	1	2	12.85	15.15	20.56	18.82	11.48	
LSD,0.05	1.0	2.4	5	1	3	0.51	0.21	0.09	0.17	0.77	

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

<sup>2</sup> 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 2 for complete scale.

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

**Table 9. Dry matter yields, seedling vigor, maturity and stand persistence of festulolium varieties sown September 7, 2010, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 14, 2010	Maturity <sup>2</sup>					Percent Stand					Height (in)					Yield (tons/acre)					3-year Total				
		2011		2012		2013	2011		2012		2013	2011		2012		2013	2011		2012		2013		Total			
		May 5	Jun 7	May 7	May 24	Oct 14	Mar 11	Nov 7	Mar 21	Oct 19	Mar 28	Oct 22	May 5	May 5	May 5	May 24	Jun 25	Aug 6	Oct 21							
<b>Commercial Varieties—Available for Farm Use</b>																										
Hykor	1.8	56.0	29.5	68.0	60.0	95	97	97	98	97	97	97	97	97	97	97	32	4.00	1.94	2.21	0.53	0.85	1.11	4.70	10.63*	
Felina	1.4	55.5	29.5	68.0	60.0	95	98	99	100	99	99	99	99	99	99	99	30	3.86	2.12	2.10	0.42	0.91	1.20	4.64	10.61*	
Perseus	4.0	43.0	54.0	49.8	56.0	98	75	99	99	75	68	79	79	75	68	79	24	5.46	2.15	1.61	0.23	0.46	0.68	2.97	10.58*	
Perun	3.0	47.5	56.5	53.5	56.5	97	100	95	96	59	46	63	23	59	46	63	23	5.13	1.78	1.85	0.23	0.61	0.56	3.25	10.15*	
SpringGreen	2.8	52.0	58.5	54.0	56.0	99	100	98	98	95	86	89	22	95	86	89	22	4.57	1.69	1.80	0.12	0.41	0.46	2.79	9.05	
Fojtan	1.0	52.5	29.0	68.0	60.0	91	96	99	99	98	98	98	20	99	98	98	20	3.17	1.79	2.04	0.34	0.71	0.91	4.00	8.97	
Barfest	2.4	38.3	48.8	51.3	55.3	96	100	100	100	96	79	80	20	100	79	80	20	4.02	2.33	1.19	0.08	0.29	0.53	2.10	8.44	
Lofa	2.8	34.3	54.0	52.7	56.7	97	100	97	97	80	70	83	23	97	80	70	23	4.76	1.49	1.40	0.17	0.36	0.23	2.16	8.41	
Gain	2.8	45.0	57.5	46.3	57.5	95	99	96	96	53	46	65	23	96	53	46	23	4.40	1.18	1.53	0.19	0.41	0.52	2.65	8.23	
Duo	5.0	53.3	62.0	55.3	56.0	100	100	92	94	90	67	83	30	92	67	83	30	3.80	1.68	1.29	0.11	0.30	0.43	2.13	7.61	
Agula	2.1	46.3	60.0	46.3	57.5	92	99	97	97	55	53	56	23	97	55	53	23	4.18	1.12	1.09	0.17	0.43	0.52	2.21	7.51	
Bonus	2.2	44.0	58.7	49.0	57.0	96	100	82	89	68	57	63	21	82	68	57	21	3.69	1.39	1.30	0.19	0.47	0.43	2.39	7.46	
SweetTart	3.4	42.5	43.3	55.0	56.7	99	100	100	99	83	58	73	20	99	83	58	20	3.73	1.45	0.72	0.10	0.20	0.39	1.40	6.59	
<b>Experimental Varieties</b>																										
KYFA9819/E1	1.8	33.0	59.0	52.0	56.5	95	97	97	97	92	84	86	19	97	92	84	19	3.96	1.88	1.66	0.11	0.36	0.43	2.57	8.41	
KYFA9819/E2	2.0	35.0	56.0	52.5	54.7	92	96	96	96	95	80	80	19	96	95	80	19	3.78	2.07	1.19	0.10	0.26	0.42	1.97	7.83	
KYFA9819/E3	1.3	34.0	58.5	52.0	56.0	92	97	98	98	87	80	78	19	98	87	80	19	3.69	1.69	1.18	0.08	0.38	0.38	2.02	7.39	
KYFA9819/EF	2.1	33.0	58.5	54.0	56.0	95	99	97	97	92	68	66	21	97	92	68	21	3.85	1.71	0.64	0.09	0.13	0.34	1.20	6.76	
Mean	2.4	43.8	51.0	54.7	57.1	95	97	97	97	83	73	79	23	97	83	73	23	4.12	1.74	1.46	19.19	0.45	0.57	2.68	8.54	
CV%	22.3	9.4	12.0	4.0	1.8	3	13	5	3	13	20	17	9	5	13	20	17	9	9.29	18.49	41.76	43.26	26.92	23.46	28.06	10.55
LSD <sub>0.05</sub>	0.8	6.0	8.9	3.2	1.7	4	19	7	4	16	23	20	3	7	4	23	20	3	0.56	0.47	0.90	0.12	0.17	0.20	1.10	1.32

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

<sup>2</sup> 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 2 for complete scale.

\*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 festulolium varieties sown September 14, 2011, at Lexington, Kentucky.

Variety	Seedling Vigor <sup>1</sup> Oct 11, 2011		Maturity <sup>2</sup>				Percent Stand				Height (in)				Yield (tons/acre)				2-year Total
	2012		2013		2012		2013		2012		2013		2012		2013		2013		
	Apr 10	Apr 30	May 20	May 24	Oct 11	Mar 21	Oct 19	Mar 28	Oct 22	Apr 10	Apr 10	May 24	Jun 28	Aug 5	Oct 22	Total	Total		
<b>Commercial Varieties—Available for Farm Use</b>																			
Perseus	3.3	32.8	45.0	55.0	100	100	100	87	91	15	15	1.84	0.77	0.68	0.50	3.80	7.55*		
Hykor	1.8	31.5	55.5	60.0	100	100	100	100	100	11	11	2.21	1.03	0.99	0.98	5.20	7.51*		
Lofa	3.0	32.8	49.3	55.5	100	100	100	91	91	15	15	3.44	2.03	0.58	0.25	3.56	7.00*		
Perun	3.0	32.5	48.5	46.8	100	100	100	74	79	14	14	3.47	1.81	0.64	0.37	3.48	6.95*		
Spring Green	3.0	32.5	56.0	56.0	100	100	100	88	94	17	17	3.36	1.94	0.40	0.48	3.32	6.68*		
Felina	1.3	30.8	54.5	60.0	100	100	100	100	100	9	9	1.74	2.12	0.89	0.84	4.77	6.51*		
Duo	4.3	48.8	—	62.0	100	100	98	91	91	26	26	2.90	2.35	0.48	0.33	3.50	6.40		
Barfest	2.6	32.0	43.5	44.0	100	100	100	94	97	12	12	2.85	1.76	0.55	0.45	3.21	6.06		
Fojtan	1.0	30.8	53.0	59.5	100	100	100	100	100	9	9	1.88	1.93	0.68	0.70	4.03	5.92		
Gain	4.6	50.0	—	62.0	100	100	56	23	20	25	25	2.60	1.46	0.47	0.11	2.81	5.42		
Sweet Tart	3.0	31.8	50.3	38.8	100	100	100	9	74	14	14	2.22	0.81	0.51	0.32	2.11	4.34		
Bonus	4.5	50.0	—	62.0	100	100	10	2	1	25	25	2.48	0.62	0.16	0.00	1.02	3.50		
<b>Experimental Varieties</b>																			
KYFA1016	2.6	32.3	39.0	51.5	100	100	100	96	97	12	12	2.77	1.80	0.42	0.33	2.96	5.74		
KYFA1015	2.3	32.3	39.0	51.5	100	100	100	96	97	12	12	2.71	1.80	0.44	0.32	2.99	5.70		
KYFA9819	2.0	32.0	40.5	52.0	100	100	100	96	95	12	12	2.42	1.47	0.48	0.27	2.60	5.02		
XLFFL	4.3	48.8	—	62.0	100	100	4	1	1	25	25	2.55	1.11	0.22	0.00	1.79	4.35		
Mean	2.9	36.3	47.8	48.1	100	100	85	72	77	16	16	2.72	1.69	0.54	0.39	3.20	5.91		
CV%	15.3	2.9	5.5	9.5	0	0	6	7	6	10	10	11.73	27.32	26.57	45.58	19.01	13.23		
LSD,0.05	0.6	1.5	3.8	6.3	0	0	8	7	7	2	2	0.45	0.54	0.21	0.25	0.87	1.12		

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

<sup>2</sup> 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 2 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 festulolium varieties sown September 7, 2012, at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup> Oct 15, 2012	Maturity <sup>2</sup>	Percent Stand			Yield (tons/acre)				
			2013	2012	2013	2013				
			May 20	Oct 15	Mar 20	Oct 22	May 20	Jun 28	Aug 6	Oct 24
<b>Commercial Varieties—Available for Farm Use</b>										
Hykor	2.5	60.0	98	98	100	3.32	1.50	1.10	1.39	7.31*
Perseus	4.0	55.0	99	100	96	4.04	1.78	0.57	0.61	7.01*
Hostyn	3.0	59.0	99	100	99	3.47	1.86	0.79	0.66	6.79*
Perun	3.3	55.5	100	100	98	3.67	1.62	0.67	0.68	6.64*
Felina	1.3	60.0	95	96	99	2.90	1.45	1.00	1.27	6.61*
Lofa	4.5	54.5	100	100	86	3.69	1.97	0.40	0.35	6.41
Spring Green	4.1	57.5	100	100	100	3.41	1.47	0.46	0.69	6.03
Mahulena	1.4	60.0	92	93	95	2.70	1.21	0.84	1.21	5.96
Fojtan	2.0	57.5	97	97	100	2.73	1.15	0.76	1.17	5.80
Duo	3.9	60.0	100	100	100	3.49	1.21	0.32	0.60	5.62
Barfest	3.8	55.5	100	100	100	3.60	1.08	0.30	0.60	5.57
SweetTart	4.6	56.5	100	85	93	2.34	1.19	0.32	0.60	4.44
Gain	4.9	61.5	100	78	18	2.25	1.15	0.34	0.20	3.94
Meadow Green	4.8	56.0	100	66	0	2.50	1.00	0.02	0.00	3.53
Bonus	5.0	60.0	100	38	2	1.95	0.80	0.06	0.04	2.86
<b>Experimental Varieties</b>										
KYFA1016	3.1	55.5	100	100	100	3.84	1.34	0.50	0.71	6.38
Amp1427	2.4	56.0	96	99	100	3.73	1.40	0.40	0.61	6.14
KYFA1015	3.0	55.5	100	100	100	3.62	1.13	0.40	0.71	5.86
KYFA9819	3.0	55.5	98	99	99	3.56	1.13	0.38	0.62	5.69
XLFFL	4.9	59.5	100	89	0	2.41	1.03	0.08	0.00	3.51
Mean	3.5	57.5	99	92	79	3.16	1.32	0.49	0.64	5.61
CV,%	13.6	2.3	2	10	8	11.30	19.06	20.96	21.31	9.57
LSD,0.05	0.7	1.9	2	12	9	0.51	0.36	0.14	0.19	0.76

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

<sup>2</sup> 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 2 for complete scale.

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

**Table 12. Performance of festulolium varieties at Lexington, Kentucky.**

Variety	Type <sup>2</sup>	Proprietor/KY Distributor	2010 <sup>1</sup>			2011		2012
			2011 <sup>3</sup>	2012	2013	2012	2013	2013
<b>Commercial Varieties—Available for Farm Use</b>								
Agula	MF x IR	Allied Seed	x <sup>4</sup>	x	x			
Barfest	MF x PR	Barenbrug USA	x	*	x	x	x	x
Duo	MF x PR	Ampac Seed	x	*	x	x	x	x
Felina	(TF x IR) x TF	DLF International	x	*	*	x	*	*
Gain	MF x IR	Allied Seed	x	x	x	x	x	x
Fojtan	(TF x IR) x TF	DLF International	x	x	*	x	x	x
Hostyn	MF x IR	DLF International						*
Hykor	(TF x IR) x TF	DLF International	x	*	*	x	*	*
Lofa	(TF x Int) x Int	DLF International	x	x	x	*	x	x
Mahulena	(TF x IR) x TF	DLF International						x
Meadow Green	—	Pure Seed						x
Perseus	MF x IR	DLF International	*	*	x	*	x	*
Perun	MF x IR	DLF International	*	x	x	*	x	*
Spring Green	MF x PR	Turf Seed	x	x	x	*	x	x
Bonus	MF x IR	Allied Seed	x	x	x	x	x	x
Sweet Tart	MF x IR	ProSeeds Marketing	x	x	x	x	x	x
<b>Experimental Varieties</b>								
Amp1427	—	Ampac Seed						x
KYFA1015	MF x IR	KY Agric. Exp. Station				x	x	x
KYFA1016	MF x IR	KY Agric. Exp. Station				x	x	x
KYFA9819EF	MF x IR	KY Agric. Exp. Station	x	x	x	x	x	x
KYFA9819E1	MF x IR	KY Agric. Exp. Station	x	*	x			
KYFA9819E2	MF x IR	KY Agric. Exp. Station	x	*	x			
KYFA9819E3	MF x IR	KY Agric. Exp. Station	x	x	x			
XLFFL	—	ProSeeds Marketing				x	x	x

<sup>1</sup> Establishment year.

<sup>2</sup> MF = meadow fescue, TF = tall fescue, IR = Italian ryegrass, PR = perennial ryegrass, Int = intermediate ryegrass

<sup>3</sup> Harvest year.

<sup>4</sup> x in the box indicates the variety was in the test but yielded significantly less than the top yielding variety. Open boxes indicate the variety was not in the test.

\*Not significantly different from the highest yielding variety in the test.

**Table 13. Performance of annual ryegrass varieties sown in 2012 at Lexington, Kentucky.<sup>1</sup>**

Variety	Type	Proprietor/KY Distributor	Lexington	
			2012 <sup>2</sup>	2013
<b>Commercial Varieties—Available for Farm Use</b>				
AE110	Westerwold tetraploid	Pickseed USA, Inc	x <sup>4</sup>	
Barmultra II	Italian tetraploid	Barenbrug		*
Big Boss	Westerwold tetraploid	Smith Seed Services		x
Bruiser	Westerwold diploid	Ampac Seed	x	
Feast II	Italian tetraploid	Ampac Seed	x	x
Fria	Westerwold diploid	Allied Seed	x	
Gulf	Westerwold diploid	Public	x	
Hercules	Westerwold diploid	Barenbrug		x
Jackson	Westerwold diploid	The Wax Company	x	x
LHT-102	Intermediate	Ampac Seed	x	
Marshall	Westerwold diploid	The Wax Company	x	*
MX 108(Max)	Westerwold tetraploid	Pickseed USA, Inc	*	
Nelson	Westerwold tetraploid	The Wax Company		*
TAMTBO	Italian tetraploid	Texas Ag Exp Sta	x	
TillageRootMax	Westerwold diploid	Cover Crop Solutions	x	
TillageMax-Bristol	Westerwold diploid	Cover Crop Solutions	x	
TillageMax-INDY	Westerwold diploid	Cover Crop Solutions	x	
Winterhawk	Westerwold diploid	Oregro Seeds	x	
<b>Experimental Varieties</b>				
Amp	Westerwold tetraploid	Columbia Seeds	x	
IS-LWT 12	Westerwold tetraploid	DLF International	x	
IS-LWT 13	Westerwold tetraploid	DLF International	x	
IS-LWT 14	Westerwold tetraploid	DLF International	x	
Lh 4x-1PS	Intermediate tetraploid	Pickseed USA, Inc	*	
ME4	Westerwold diploid	The Wax Company		*
ME-94	Westerwold diploid	The Wax Company		x
M2CVS	—	The Wax Company		x
PPG-LMT-103	Italian tetraploid	Mountain View Seeds	*	
PPG-LWD-101	Westerwold diploid	Mountain View Seeds	x	
PS-Lm-09-2	Westerwold tetraploid	Pickseed USA, Inc	*	

<sup>1</sup> See Table 15 for summary of yield data on named varieties from 2000-2013.

<sup>2</sup> Establishment year.

<sup>3</sup> Harvest year.

<sup>4</sup> x in the box indicates the variety was in the test but yielded significantly less than the top yielding variety. Open boxes indicate the variety was not in the test.

\*Not significantly different from the highest yielding variety in the test.

**Table 14. Performance of perennial ryegrass across years.**

Variety	Type	Proprietor/KY Distributor	Lexington		
			2011 <sup>1</sup>	2012	2013
<b>Commercial Varieties—Available for Farm Use</b>					
BG34	diploid	Barenbrug USA			x <sup>3</sup>
Boost	tetraploid	Allied Seed	*	*	x
Calibra	tetraploid	DLF International	x	*	x
Crave	tetraploid	Ampac Seed Company			x
Elena DS	tetraploid	Allied Seed			x
Granddaddy	tetraploid	Smith Seed Services	x	x	x
Impressario	tetraploid	DLF International			x
Kentaur	tetraploid	DLF International	*	*	
LHT-102	tetraploid	Ampac Seed Company			*
Linn	diploid	Public	x	x	x
Power	tetraploid	Ampac Seed Company	*	*	x
TetraGain	tetraploid	Pure Seed			x
Verseka	tetraploid	Allied Seed			x
<b>Experimental Varieties</b>					
IS-FLPD6	diploid	DLF International			x
IS-FLPT5	tetraploid	DLF International			x
IS-FLPT6	tetraploid	DLF International			x
PPG-FPRD 104	diploid	Mountain View Seeds			x
PPG-FPRT 105	tetraploid	Mountain View Seeds			x
PPG-LHT 104	tetraploid	Mountain View Seeds			*
XLFTETPRG	tetraploid	ProSeeds Marketing	*	*	

<sup>1</sup> Establishment year.

<sup>2</sup> Harvest year.

<sup>3</sup> x in the box indicates the variety was in the test but yielded significantly less than the top yielding variety. Open boxes indicate the variety was not in the test.

\*Not significantly different from the highest yielding variety in the test.











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