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2009 Native Warm-Season Perennial Grasses Report

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Introduction

Kentucky's pasture and hay acres are largely seeded in cool-season species. This practice results in a natural decline in midsummer production and often limits livestock production. High-yielding, native warm-season perennial grasses are viable options for Kentucky livestock enterprises and the emerging biomass market and provide an additional benefit of wildlife habitat. Little is known about the performance of different varieties of the primary native warm-season species in Kentucky. They include switchgrass (*Panicum virgatum L.*), big bluestem (*Andropogon gerardii Vitman*), indiangrass (*Sorghastrum nutans* [*L.*] Nash) and eastern gamagrass (*Tripsacum dactyloides L.*). This report provides current yield and plant characteristic data for 2001 to 2009.

The UK Forage Extension Web site at www.uky.edu/Ag/Forage contains electronic versions of all forage variety testing reports from Kentucky and surrounding states and from a large number of other forage publications.

Table 1. Ecological and/or breeding background of the native varieties used in this study.

Big Bluestem	KYAG 9601	Ecotype collection from western KY / near Land between the Lakes area with minimal selection for disease resistance.
	Wapiti	Ecotype collection from Hart County, Kentucky by Randy and John Seymour/Roundstone Native Seeds.
	Pawnee	Released variety from Nebraska.
	Kaw	Released variety from Kansas.
	Roundtree	Released variety from Missouri (orginial plant collection from Iowa).
Indiangrass	Cheyenne	Released variety from Oklahoma.
	Rumsey	Released variety from Missouri (original plant collection from Illinois).
	Nebraska 54	Ecotype collection from Nebraska and released as a variety.
	Osage	Original plants collected from Kansas and Oklahoma, released as a variety from Kansas.
	Washington County	Ecotype collection from the Bluegrass Parkway right-of-way in Washington County by Tim Phillips/University of Kentucky with minimal selection for improved agronomic characteristics.
	Big Barren Indian	Ecotype collection from Hart county, Kentucky by Randy and John Seymour/Roundstone Native Seeds.
Eastern gamagrass	Meade County	Ecotype collection from Meade County, Kentucky by Henry Burkwat with minimal selection for disease resistance.
	Hart	Ecotype collection from Hart County, Kentucky by Randy and John Seymour/Roundstone Native Seeds.
	Highlander	Released variety from Mississippi.
	PMK 24	Ecotype collection from Kansas and Oklahoma (similar to Pete).
	Iuka	Released variety
	Jackson	Released variety
Switchgrass	Alamo	Released variety from Texas (lowland type).
	Cave-in-Rock	Released variety from Illinois (upland type).
	KYPV 9504	Original plants collected from West Virginia to form KY-1625 then selected for uniform leaf color and width (upland type).
	KYPV 9505	Original plants collected from West Virginia to form KY-1625 then selected for improved agronomic characteristics (upland type).
	KYPV 9506	Original plants collected from West Virginia to form KY-1625 then selected for improved agronomic characteristics (upland type).
	Trailblazer	Released variety from Nebraska with selection for improved digestibility (upland type).

Description of the Tests

Small (5 by 15 feet) plots of switchgrass, big bluestem, indiangrass, and eastern gamagrass varieties were established in the summer of 2000 at the UK Agriculture Experiment Station at Lexington, Kentucky. The background for each variety is described in Table 1. Although normally established using seed, to ensure uniform stands these experimental plots were established by transplanting small plants raised in greenhouse float trays from seed or sprigs. Plots were allowed to become established during the remainder of 2000. Transplants were set 1 foot apart using four rows per plot. The plots were arranged in a randomized complete block design, with four replications. The soil at Lexington is a well-drained Maury silt loam that is well suited for grass production. The grasses were harvested once or twice during the summer when approximately 50 percent of the plants were heading. Plots were harvested to 6 inches in 2001 to 2003 and in 2005 to 2009 using a mechanical sickle bar harvester. In 2004 the height of cut was 3 to 4 inches. Fresh weight samples were taken at each harvest to determine dry matter production. Plots were fertilized with 60 lb/A of actual N at spring greenup, and other fertilizers (lime, P, and K) were applied according to University of Kentucky recommendations.

Results

Weather data for Lexington for 2001 to 2009 are presented in Table 2. In 2004 precipitation in Lexington was 7.5 inches above long-term averages. In the 2005, 2007 and 2008 growing seasons, rainfall in Lexington was well below the long-term average. Yield data (on a dry matter basis) are presented in Tables 3 through 6. Eastern gamagrass and switchgrass matured earlier than did big bluestem, and indiangrass showed the latest maturity of all species.

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

Discussion

These results indicate that warm-season native grasses have potential in Kentucky for livestock producers, as biomass crops, and for wildlife habitat, but there are several limitations to widespread use. The establishment challenges (slow germination and emergence) make these grasses susceptible to weed competition during the seeding year. Currently no herbicides are labeled for the establishment of these grasses except those applied to suppress the existing vegetation, such as paraquat or glyphosate. This situation is changing, but it is likely that Kentucky farmers will continue to have limited options for residual weed control with these grasses. Therefore, producers should plan to use cultural weed control options such as mowing or light grazing. In addition, these grasses must be rotationally grazed and allowed to rest in the fall to build up sufficient energy reserves for overwinter survival.

The yields of these species are high and come in mid- to late summer, when cool-season grasses are not productive. These grasses can play a role in Kentucky hay, pasture and biomass production systems if producers are prepared to manage them through the establishment phase and supply proper management to achieve persistence. Varieties of native grasses are limited, and the overall supply of seed varies annually. The commercial varieties shown here appear to be adapted to Kentucky but will vary in yield potential. Before buying seed of varieties not tested in Kentucky, review yield and survival information from adjacent states. When warm-season native grass varieties are moved more than 300 miles north or south from their point of origin, long-term survival suffers.

Table 2a. Temperature and rainfall at Lexington, Kentucky in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2009.

	2001				2002				2003				2004				2005			
	Temperature		Rainfall		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	°F	DEP	IN	DEP
JAN	31	0	0.92	-1.94	38	+7	2.12	-0.74	26	-5	0.96	-1.90	30	-1	3.14	+0.28	37	+6	4.35	+1.49
FEB	40	+5	3.20	-0.01	38	+3	1.28	-1.93	32	-3	3.59	+0.38	36	+1	1.32	-1.89	39	+4	1.68	-1.53
MAR	40	-4	2.73	-1.67	45	+1	7.93	+3.53	47	+3	2.09	-2.31	47	+3	3.43	-0.97	41	-3	2.79	-1.61
APR	59	+4	1.66	-2.22	58	+3	4.19	0.31	57	+2	3.14	-0.74	55	0	3.06	-0.82	56	+1	3.30	-0.58
MAY	66	+2	4.85	+0.38	61	-3	4.36	-0.11	63	-1	6.68	+2.21	68	+4	9.79	+5.32	61	-3	1.78	-2.69
JUN	71	-1	2.04	-1.12	74	+2	2.45	-1.21	69	-3	4.85	+1.19	72	0	3.13	-0.53	75	+3	1.33	-2.33
JUL	75	-1	5.58	+0.58	78	+2	1.10	-3.90	74	-2	2.68	-2.32	73	-3	7.65	+2.65	77	+1	3.30	-1.70
AUG	76	+1	4.75	+0.82	77	+2	0.95	-2.98	75	0	5.26	+1.33	71	-4	2.91	-1.02	78	+3	3.34	-0.59
SEP	65	-3	2.99	-0.21	72	+4	4.90	1.70	65	-3	4.22	+1.02	68	0	2.61	-0.59	72	+4	0.59	-2.21
OCT	56	-1	3.62	+1.05	55	-2	5.61	3.04	56	-1	1.61	-0.96	58	+1	5.65	+3.08	58	+1	0.92	-1.65
NOV	51	+6	2.83	-0.56	43	-2	3.76	0.37	50	+5	4.63	+1.24	49	+4	6.29	+2.90	47	+2	1.54	-1.85
DEC	41	+5	2.57	-1.41	36	0	4.11	-1.13	36	0	3.26	-0.72	36	0	3.20	-0.78	32	-4	2.19	-1.79
Total			37.74	-6.81			42.73	-1.79			42.97	-1.58			52.18	+7.63			27.51	-17.04

1 DEP is departure from the long-term average.

Table 2b. Temperature and rainfall at Lexington, Kentucky in 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2009.

	2006				2007				2008				2009[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	42	+11	4.77	+1.91	37	+6	2.93	+0.07	33	+2	4.60	+1.74	28	-3	2.45	-0.41
FEB	36	+1	2.13	-1.08	27	-8	1.83	-1.38	36	+1	5.37	+2.16	38	+3	2.86	-0.35
MAR	44	0	3.05	-1.35	52	+8	1.97	-2.43	45	+1	6.28	+1.88	48	+4	2.19	-2.21
APR	59	+4	3.52	-0.36	53	-2	3.87	-0.01	55	0	5.72	+1.84	55	0	4.48	+0.60
MAY	62	-2	2.99	-1.48	68	+4	1.45	-3.02	62	-2	4.88	+0.41	64	0	5.05	+0.58
JUN	70	-2	1.82	-1.84	74	+2	1.77	-1.89	74	+2	3.30	-0.36	74	+2	5.41	+1.75
JUL	76	0	5.13	+0.13	74	-2	6.90	+1.90	76	0	2.54	-2.46	71	-5	5.89	+0.89
AUG	76	+1	3.23	-0.70	80	+5	2.56	-1.37	75	0	1.08	-2.85	73	-2	5.38	+1.45
SEP	64	-4	9.27	+6.07	72	+4	1.15	-2.05	72	+4	1.21	-1.99	68	0	5.37	+2.17
OCT	54	-3	4.88	+2.31	63	+6	5.28	+2.71	57	0	1.35	-1.22	54	-3	4.83	+2.26
NOV	47	+2	1.78	-1.61	46	+1	2.86	-0.53	43	-2	2.28	-1.11	49	+4	0.94	-2.45
DEC	42	+6	2.45	-1.53	40	+4	5.29	+1.31	35	-1	4.76	+0.78				
Total			45.02	+0.47			37.86	-6.69			43.37	-1.18			44.85	+4.28

1 DEP is departure from the long-term average.
2 2009 data is for eleven months through November.

Summary

This study indicates that native grasses can contribute significantly to pasture, hay and biomass production systems in Kentucky. For further information on native grasses in Kentucky, refer to the College of Agriculture publication *Native Warm-Season Perennial Grasses for Forage in Kentucky* (AGR-145), available at your county Extension office or online at http://www.uky.edu/Ag/Forage.

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Table 3. Dry matter yields and maturity of big bluestem varieties transplanted July 18, 2000 at Lexington, Kentucky.

	Maturity[1]						Yield (tons/A)[2]											
	2004	2005	2006	2007	2008	2009	2001	2002	2003	2004	2005	2006	2007	2008	2009			8-year
Variety	Jul 28	Jul 26	Jul 18	Jul 23	Jul 3	Jun30	Total	Total	Total	Total	Total	Total	Total	Total	Jun 30	Aug 25	Total	Total[3]
KYAG 9601	50.0	60.0	46.3	46.3	39.8	35.5	4.37	4.55	3.46	7.21	3.15	4.11	4.57	4.78	3.44	1.15	4.60	36.42*
Wapiti[4]	50.0	45.0	45.0	45.0	36.5	35.5	–	3.78	4.51	6.65	2.63	3.32	3.96	4.29	3.37	1.41	4.78	33.93*
Pawnee	62.0	62.0	52.5	55.0	44.0	46.3	4.83	3.37	3.82	6.35	2.62	3.08	3.53	3.98	3.36	1.10	4.45	31.21
Kaw	62.0	62.0	54.5	56.0	46.0	50.0	4.78	3.39	3.99	4.82	2.59	2.39	3.48	3.43	3.43	0.91	4.35	28.44
Roundtree	62.0	62.0	54.0	52.5	37.5	46.3	4.67	2.77	1.79	5.19	2.02	2.76	3.23	3.19	3.02	1.21	4.23	25.18
Mean	57.2	58.2	50.5	51.0	40.8	42.7	4.66	3.57	3.51	6.04	2.61	3.13	3.75	3.93	3.32	1.16	4.48	31.04
CV,%	0.0	0.0	4.0	4.6	12.5	10.4	10.18	13.05	8.25	8.86	9.10	15.60	7.95	14.33	10.50	14.72	10.40	6.73
LSD,0.05	0.0	0.0	3.1	3.6	7.9	6.8	0.8	0.7	0.5	0.8	0.4	0.8	0.5	0.9	0.5	0.3	0.7	3.2

1 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.
2 Total yield in 2001, 2004 and 2008 is from 2 harvests.
3 2001 yield data is not included in the multiyear total.
4 Due to variation in transplant size and growth, this entry was not fully established until 2002.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 4. Dry matter yields and maturity of Indiangrass varieties transplanted July 18, 2000 at Lexington, Kentucky.

	Maturity[1]							Yield (tons/A)[2]									
	2002	2004	2005	2006	2007	2008	2009	2001	2002	2003	2004	2005	2006	2007	2008	2009	8-year
Variety	Jul 16	Jul 28	Aug 18	Aug 2	Aug 9	Aug 22	Aug 25	Aug 7	Jul 16	Aug 14	Total	Aug 18	Aug 2	Aug 9	Aug 22	Aug 25	Total[3]
Cheyenne	37.3	45.0	68.0	45.0	45.0	42.8	57.0	6.44	6.88	6.95	7.50	3.41	4.83	5.52	5.82	6.17	47.08*
Rumsey	36.5	45.0	56.5	46.3	45.0	40.5	53.0	6.25	5.67	5.79	6.47	3.08	5.20	4.77	5.45	5.96	42.38*
Nebraska 54	36.8	45.0	68.0	45.0	47.5	42.0	61.5	7.12	6.63	6.31	5.19	2.03	3.05	2.90	3.98	4.55	34.64
Osage	34.5	45.0	68.0	45.0	46.3	41.3	58.5	6.24	5.29	5.90	5.41	2.44	3.46	3.09	4.71	4.19	34.50
Washington County	36.0	45.0	56.5	45.0	45.0	36.0	59.0	5.01	4.98	5.44	5.41	1.92	3.13	3.34	4.36	4.48	33.07
Big Barren Indian[4]	34.5	45.0	50.8	42.0	45.0	37.5	56.0	–	2.84	4.33	5.26	1.86	2.97	3.35	3.60	6.22	30.42
Mean	35.9	45.0	61.3	44.7	45.6	40.0	57.5	6.21	5.38	5.79	5.87	2.46	3.77	3.83	4.85	5.26	37.01
CV,%	6.7	0.0	13.6	2.3	3.6	6.8	5.5	9.10	15.04	22.19	18.19	13.80	15.88	13.26	15.85	33.90	15.01
LSD,0.05	3.6	0.0	12.5	1.5	2.5	4.1	4.8	0.87	1.22	1.94	1.61	0.51	0.90	0.76	1.11	2.69	8.37

1 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.
2 Total yield in 2004 is from 2 harvests.
3 2001 yield data is not included in the multiyear total.
4 Due to variation in transplant size and growth, this entry was not fully established until 2002.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 5. Dry matter yields and maturity of eastern gamagrass varieties transplanted July 18, 2000 at Lexington, Kentucky.

	Maturity[1]							Yield (tons/A)[2]											
	2002	2004	2005	2006	2007	2008	2009	2001	2002	2003	2004	2005	2006	2007	2008	2009			8-year
Variety	Jun 18	Jul 28	Jun 28	Jun 15	Jun 19	Jun 18	Jun15	Total	Total	Total	Total	Total	Total	Total	Total	Jun 15	Aug 25	Total	Total[3]
Meade County	53.3	75.0	61.0	46.8	45.8	38.5	38.5	7.91	8.00	12.30	8.38	4.64	4.21	3.56	4.04	2.00	2.01	4.01	49.15*
Hart	46.5	75.0	49.5	40.0	29.5	31.5	32.0	4.98	7.27	11.09	7.65	4.13	4.22	3.78	3.73	1.81	2.08	3.90	45.76*
Highlander[4]	50.8	75.0	61.0	49.3	49.5	53.0	53.8	–	7.16	10.74	7.52	3.38	3.91	3.77	3.83	1.73	2.25	3.98	44.30*
PMK 24[5]	63.3	75.0	85.0	64.0	62.0	65.0	63.0	6.38	5.80	8.58	5.35	3.07	3.47	3.25	3.50	2.37	2.10	4.47	37.49
Iuka[4]	63.8	75.0	85.0	64.0	62.0	67.0	63.5	–	3.24	7.10	4.65	2.33	2.89	2.47	2.99	2.04	1.79	3.82	29.50
Jackson[4]	43.5	75.0	49.0	45.7	37.8	37.3	43.3	–	3.78	7.68	4.83	1.31	2.09	2.54	2.89	1.17	2.36	3.54	28.66
Mean	53.5	75.0	65.1	51.9	47.8	48.7	49.0	6.42	5.88	9.58	6.40	3.14	3.46	3.23	3.50	1.85	2.10	3.95	39.14
CV,%	7.2	0.0	16.4	2.8	21.6	14.3	15.3	10.19	10.82	12.62	15.99	22.13	18.46	10.91	12.17	14.31	8.35	8.92	9.19
LSD,0.05	2.8	0.0	16.0	2.2	15.5	10.5	11.3	1.13	0.96	1.82	1.54	1.05	0.96	0.53	0.64	0.40	0.26	0.53	5.42

1 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.
2 Total yield is from 2 harvests in 2001-2008.
3 2001 yield data is not included in the multiyear total.
4 Due to variation in transplant size and growth, these entries were not fully established until 2002.
5 Same genetic background as Pete, uncertified seed.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Dry matter yields and maturity of switchgrass varieties transplanted July 18, 2000 at Lexington, Kentucky.

	Maturity[1]							Yield (tons/A)[2]											
	2002	2004	2005	2006	2007	2008	2009	2001	2002	2003	2004	2005	2006	2007	2008	2009			9-year
Variety	Jun 18	Jul 28	Jul 26	Jul 18	Jun 19	Jun 23	Jun 30	Total	Total	Total	Total	Jul 26	Jul 18	Total	Total	Jun 30	Aug 25	Total	Total
Cave in Rock	55.8	75.0	75.0	62.0	45.0	45.8	56.0	7.26	5.64	7.44	6.24	4.16	4.65	6.52	3.95	3.17	0.51	3.68	49.56*
Alamo	47.5	50.0	45.0	45.0	45.0	41.5	45.0	8.68	8.00	11.59	4.85	2.03	3.04	4.15	2.60	2.14	1.00	3.14	48.08*
KYPV 9504	49.8	75.0	56.5	53.5	33.0	39.0	45.0	5.53	4.62	7.33	6.30	3.19	3.97	5.19	3.55	2.99	0.57	3.56	43.25
KYPV 9505	52.0	75.0	61.3	55.5	42.0	34.5	46.3	5.52	4.81	7.41	6.34	3.09	3.85	4.23	2.93	2.68	0.15	2.83	41.01
KYPV 9506	52.5	75.0	57.0	54.0	35.8	31.5	51.8	5.08	5.07	7.04	5.91	3.28	3.61	4.04	3.03	2.37	0.25	2.62	39.69
Trailblazer	51.0	75.0	71.8	56.5	45.0	33.8	49.5	4.41	4.28	5.75	4.77	2.38	2.26	2.25	2.10	1.55	0.14	1.70	29.90
Mean	51.4	70.4	61.1	54.4	41.0	37.7	48.9	6.08	5.41	7.76	5.73	3.02	3.56	4.40	3.03	2.48	0.44	2.92	41.91
CV,%	2.2	0.0	8.3	1.3	9.4	8.3	6.5	9.15	8.71	15.54	16.19	16.19	21.97	13.09	12.36	15.98	70.26	21.28	7.79
LSD,0.05	1.7	0.0	7.6	1.0	5.8	4.7	4.8	0.84	0.71	1.82	1.40	0.74	1.18	0.87	0.56	0.60	0.46	0.94	4.92

1 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.
2 Total yield is from 2 harvests in 2001, 2002, 2003, 2004, 2007 and 2008.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

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