Maryland Cool-Season Grass Forage Trial Final Report

INTRODUCTION

Maryland farmers can benefit from a greater knowledge of variety performance in Maryland growing conditions. This valuable information enables farmers to make more informed decisions for maximizing production in a sustainable manner that will conserve natural resources and benefit their bottom line.

This forage variety trial was conducted by the USDA's Natural Resources Conservation Service (NRCS) and University of Maryland to provide the latest information on the agronomic performance of publicly and privately developed cool-season grass varieties. This report summarizes data collected that will be of mutual benefit to the farmers of Maryland and surrounding states, the seed industry, University of Maryland Extension and NRCS.

The cool-season grass forage variety trial was seeded September 25th, 2005 at the NRCS's Norman A. Berg National Plant Materials Center located on the Beltsville Agricultural Research Center at Beltsville, Maryland. Seed dealers and distributors and grass breeders were invited to submit entries of released varieties or advanced breeding lines that they would like evaluated in Maryland. The seed marketers that contributed varieties are listed at the end of this report.

The 18 cool-season grass entries in this trial are varieties of tall fescue, orchardgrass, Alaska brome, pasture brome, festulolium and perennial ryegrass. Yields are not reported for varieties that have not persisted.

EXPERIMENTAL DESIGN AND CONDUCT

The trial was planted in a randomized complete block with 4 replications. Plot size is 3 feet × 20 feet with yield measurements taken from the entire plot area. Stand ratings were recorded to capture information for establishment and persistence. Cuttings were made using a Carter flail-type harvester and cut to a height of 3 inches when the grasses achieved a target height of 10-12 inches. Establishment was severely limited by drought in the fall of 2005 and spring of 2006. The first significant rainfall after seeding did not occur until October 7th and 8th. Supplemental irrigation was applied as needed to maintain good survival, but was not sufficient for optimal growth. No yield data was collected in 2006 due to the drought conditions in the spring and summer. Replication 1 was eliminated from the data analysis because of severe stand mortality of many of the entries due to variations in the soils that amplified the drought impact. Fertilizer applications of phosphorus and potash were applied only to meet soil test recommendations. Nitrogen was applied at a rate of 60 pounds of available nitrogen in April, after the first harvest and in late summer. Cuttings were made for all plots when 10-12 inches of height was achieved by tallest and faster growing varieties.

PRECIPITATION

The precipitation amounts by monthly total for the trial period growing seasons are reported in Figures 1 through 6. Below average precipitation in the 2007 growing season and extremely low precipitation in the months of May, July and September were a significant factor influencing yield in the 2007 season. Precipitation in the 2008 growing season was about 10% below average from March through November, and was well below average in the months of March, August and October. Precipitation in the 2009 growing season was above average in all months except for March, July and September. Precipitation in the 2010 growing season was below average in all months except March, August and September.

Figure 1. Fall 2005 Precipitation at the National Plant Materials Center

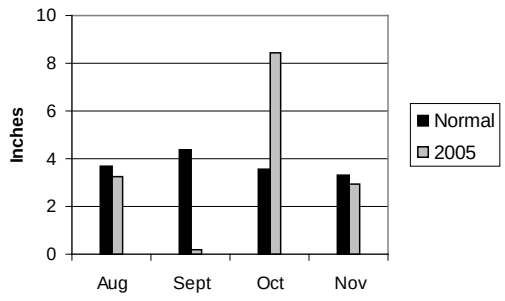


Figure 2. 2006 Precipitation at the National Plant Materials Center

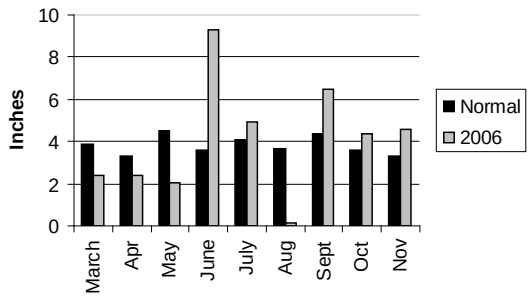


Figure 3. 2007 Precipitation at the National Plant Materials Center

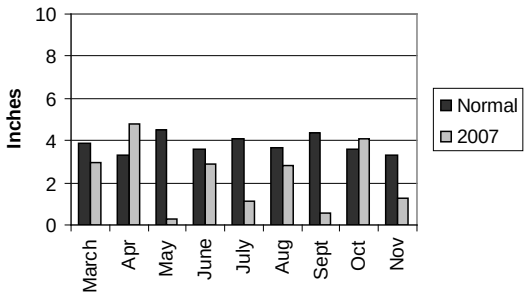


Figure 4. 2008 Precipitation at the National Plant Materials Center

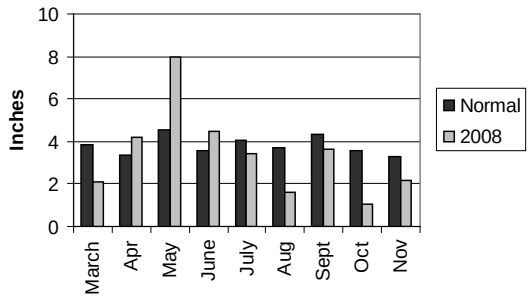


Figure 5. 2009 Precipitation at the National Plant Materials Center

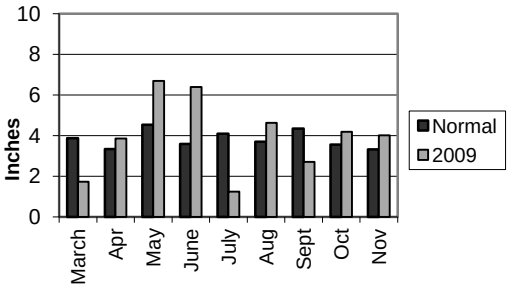
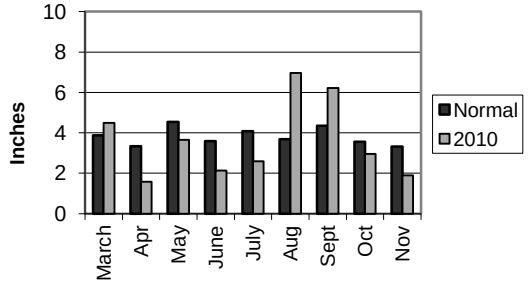


Figure 6. 2010 Precipitation at the National Plant Materials Center



INTERPRETING DATA AND STAND SCORES

Summary of yields and stand scores are reported in Tables 1 through 5. Varieties are grouped according to species/type and are ranked according to the 4-year average yield performance in Table 1 and according to the annual yield performance in Tables 2 through 5.

The stand score is a visual estimate of the proportion of groundcover attributed to by the planted variety, and provides a useful measure of persistence. The stand score scale is from 1 to 100 with 1 equaling 'no plants of the seeded species/variety present' and 100 equaling 'complete cover of plants of the seeded variety.' Varieties that did not persist with a minimum of 50% stand were not included in the data analyses. **The varieties that did not persist into 2008 were 'Hakari' Alaska brome, 'Bareno' pasture brome, 'Athos', 'Intensive' and 'Barexcel' orchardgrass, 'Perun' festulolium, and 'Grandaddy' perennial ryegrass.** All varieties that persisted into 2008 also persisted into 2010. Reductions in stand density usually occurred after hot and dry summers indicating a lack of tolerance to heat and water stress.

The trial included advanced experimental entries to be evaluated for possible future releases as named commercial varieties.

Data presented in Tables 1 through 5 can be used to evaluate the relative performance of the cool-season forage varieties in years 2007 to 2010. Comparisons can be statistically evaluated by using Fisher's Least Significant Difference (LSD) test. The LSD value represents the amount of yield which varieties must differ by in order to determine whether the difference between varieties could have happened by chance alone. The value for coefficient of variation (CV) is a measure of the relative variation. Analysis of variance was conducted using the Randomized Complete Block Model from Statistix 8 (v 8.2, 2007, Analytical Software, Tallahassee, FL). Fisher's LSD test was used to determine the differences between variety means for each year. Significance was determined for all analyses at the 0.05 probability level.

In forage trials, the CV for yield is typically between 5 and 15 percent. Uncontrollable or immeasurable variations in soil type, soil fertility, soil moisture and environmental factors contribute to increased CV values. Soil type and moisture variations within the plot area of this trial were undoubtedly major contributors to the increased CV values.

RESULTS AND DISCUSSION

In the 2010 season, yields were on average lower than in 2008 or 2009. These lower yields may be due to both weather and fewer harvests in 2010. June, July and early August were dry and the plots were overtaken by crabgrass and other warm-season annual grasses, invalidating the late summer and fall harvest data. The tall fescue varieties consistently yielded significantly higher and had better persistence than varieties of other species. The tall fescue variety 'Kora' yielded the highest for the four-year average, but not significantly higher than the lowest yielding tall fescue variety 'Enhance'. 'Kora', 'Select' and 'Enhance' are low endophyte or endophyte-free varieties. Varieties of orchardgrass, festulolium, perennial ryegrass and bromegrass had poor persistence with many not persisting into the 2010 season. Data collection was concluded in 2010.

Tall fescue varieties are a good choice for farmers requiring reliable and persistent high yielding forage. When choosing among varieties of tall fescue, other considerations may be more important than yield, such as choosing among low endophyte, friendly endophyte and standard endophyte varieties when considering the animal health effects that standard endophyte varieties can have.

The poor orchardgrass persistence in this study is consistent with persistence problems being experienced by hay and pasture producers throughout the Mid-Atlantic Region. We are seeing numerous cases of reduced vigor (fewer cuttings and lower annual yields) and early death of orchardgrass stands compared to only 6 to 8 years ago. Some hay growers in Southern Maryland have reported complete stand losses within a year of seeding. So the results of this study are consistent with, and reflect, what is happening on many farms. Efforts are being made to identify possible causes for this reduced vigor and early stand loss through other studies and field surveys.

An additional study is proposed to provide frequent and cumulative dry matter yield data for refining seasonal growth curves used in the C-graze planning tool. This proposed study will make use of a rising plate meter and calibration cuttings to obtain a database of meter readings that correspond to yields of various species/varieties of forage grasses. A database of rising plate meter readings for forage grasses in Maryland would enable further measurements on working farms and provide refinements to growth curve models in Maryland.

Table 1. 2007 to 2010 yield comparison of cool-season forage cultivars by annual total and 4-year average at the USDA-NRCS National Plant Materials Center, Beltsville, Maryland.

		Forage Yield (lb/acre)				
Species/Variety	**Marketer**	**2007**	**2008**	**2009**	**2010**	**4-Year Average**
Tall Fescue						
Kora	DLF-Intl. Seeds	3,616	5,770	7,224	3,706	5,079
BAR FA BTR9	Barenbrug USA	3,350	6,135	5,801	4,087	4,843
BAR FA 6FRD	Barenbrug USA	3,413	5,837	6,321	3,788	4,840
Select	FFR Cooperative	3,383	5,902	6,161	3,751	4,799
BAR FA 9301A	Barenbrug USA	3,581	5,832	5,655	2,854	4,480
Max Q Jesup	Pennington	3,307	5,574	4,835	3,833	4,387
KY-31	Public	3,447	4,315	5,125	2,968	3,964
Enhance	Allied Seed	3,373	4,434	4,721	2,696	3,805
Perennial ryegrass						
Remington	Barenbrug USA	2,516	3,027	2,799	536	2,220
Orchardgrass						
Benchmark Plus	FFR Cooperative	1,911	2,545	2,464	561	1,870
Extend	Allied Seed	1,856	2,821	2,138	0	1,704
Mean		3,069	4,745	4,840	2,616	3,818
LSD[1/] $_{(0.05)}$		NS[3/]	1,908	1,921	1,422	1,384
% CV[2/]		28	24	23	32	21

1/ = least significant difference test at 5% level of probability; 2/ = coefficient of variation; 3/ = not significant

Table 2. 2010 yield comparison of cool season forage cultivars by harvest date and season total at the USDA-NRCS National Plant Materials Center, Beltsville, Maryland.

		2010 Forage Yield (lb/acre)		
Species/Variety	**Marketer**	**28-Apr**	**15-Jun**	**Total**
Tall Fescue				
BAR FA BTR9	Barenbrug USA	572	3,514	4,087
Max Q Jesup	Pennington	774	3,058	3,833
BAR FA 6FRD	Barenbrug USA	881	2,907	3,788
Select	FFR Cooperative	839	2,911	3,751
Kora	DLF-Intl. Seeds	443	3,263	3,706
KY-31	Public	455	2,513	2,968
BAR FA 9301A	Barenbrug USA	723	2,130	2,854
Enhance	Allied Seed	424	2,271	2,696
Perennial ryegrass				
Remington	Barenbrug USA	80	456	536
Orchardgrass				
Benchmark Plus	FFR Cooperative	161	400	561
Extend	Allied Seed	0	0	0
Mean		487	2,130	2,616
LSD[2/] (0.05)		461	1,192	1,422
% CV[3/]		56	33	31.91

1/ = not harvested; 2/ = least significant difference test at 5% level of probability; 3/ = coefficient of variation; 4/ = not significant

Table 3. 2009 yield comparison of cool season forage cultivars by harvest date and season total at the USDA-NRCS National Plant Materials Center, Beltsville, Maryland.

		2009 Forage Yield (lb/acre)				
Species/Variety	**Marketer**	**May 12**	**June 30**	**Aug. 17**	**Nov. 5**	**Total**
Tall Fescue						
Kora	DLF-Intl. Seeds	2,334	2,455	1,368	1,067	7,224
BAR FA 6FRD	Barenbrug USA	1,948	2,150	1,131	1,092	6,321
Select	FFR Cooperative	2,137	1,827	1,206	991	6,161
BAR FA BTR9	Barenbrug USA	1,844	1,799	1,075	1,083	5,801
BAR FA 9301A	Barenbrug USA	2,008	2,065	696	886	5,655
KY-31	Public	1,943	1,524	714	945	5,125
Max Q Jesup	Pennington	1,440	1,552	1,013	829	4,835
Enhance	Allied Seed	1,991	1,781	298	651	4,721
Perennial ryegrass						
Remington	Barenbrug USA	1,271	1,309	37	181	2,799
Orchardgrass						
Benchmark Plus	FFR Cooperative	1,402	822	107	133	2,464
Extend	Allied Seed	1,394	744	nh[1/]	nh[1/]	2,138
Mean		1,792	1,639	695	715	4,840
LSD[2/] (0.05)		NS[4/]	926	609	409	1,921
% CV[3/]		33	33	51	33	23

1/ = not harvested; 2/ = least significant difference test at 5% level of probability; 3/ = coefficient of variation; 4/ = not significant

Table 4. 2008 Yield comparison of cool season forage cultivars by harvest date and season total at the USDA-NRCS National Plant Materials Center, Beltsville, Maryland.

		2008 Forage Yield (lb/acre)						Stand 6/3/08
Species/Variety	Marketer	April 18	May 7	June 3	July 2	Nov 7	Total	(%)
Tall Fescue								
BAR FA BTR9	Barenbrug USA	565	1,064	1,210	1,939	1,357	6,135	97.7
Select	FFR Cooperative	766	1,168	854	2,116	999	5,902	92.7
BAR FA 6FRD	Barenbrug USA	692	991	902	2,338	915	5,837	95.0
BAR FA 9301A	Barenbrug USA	510	1,069	1,198	2,670	385	5,832	98.3
Kora	DLF-Intl. Seeds	565	927	1,109	2,173	997	5,770	81.0
Max Q Jesup	Pennington	663	1,158	783	2,031	938	5,574	93.3
Enhance	Allied Seed	665	1,019	722	2,029	nh[1/]	4,434	100.0
KY-31	Public	640	1,041	600	1,637	397	4,315	98.3
Perennial ryegrass								
Remington	Barenbrug USA	nh[1/]	352	697	1,979	nh[1/]	3,027	74.3
Orchardgrass								
Extend	Allied Seed	281	633	373	1,354	179	2,821	48.3
Benchmark Plus	FFR Cooperative	384	549	467	1,145	nh	2,545	48.3
Mean		521	906	810	1,946	561	4,745	84
LSD[2/] $_{(0.05)}$		353	495	362	NS[4/]	NS[4/]	1,908	29
% CV[3/]		40	32	26	26	101	24	20

1/ = not harvested; 2/ = least significant difference test at 5% level of probability; 3/ = coefficient of variation; 4/ = not significant

Table 5. 2007 yield comparison of cool season forage cultivars by harvest date and season total at the USDA-NRCS National Plant Materials Center, Beltsville, Maryland.

		Forage Yield (lb/acre)					Stand 4/23/07
Species/Variety	Marketer	May 4 or 9	May 23	June 22	Nov 29	Total	(%)
Tall Fescue							
Kora	DLF-Intl. Seeds	*1,210	811	1,162	433	3,616	85.3
BAR FA 9301A	Barenbrug USA	*838	724	1,336	683	3,581	84.3
KY-31	Public	*725	627	1,228	867	3,447	95.0
BAR FA 6FRD	Barenbrug USA	*1,059	777	940	636	3,413	80.0
Select	FFR Cooperative	*1,302	734	900	447	3,383	82.7
Enhance	Allied Seed	*570	482	1,494	827	3,373	86.0
BAR FA BTR9	Barenbrug USA	948	595	901	906	3,350	77.7
Max Q Jesup	Pennington	*751	765	1,048	591	3,155	85.0
Festulolium							
Perun	DLF-Intl. Seeds	837	505	1,479	nh[1/]	2,821	70.3
Perennial ryegrass							
Remington	Barenbrug USA	538	491	1,350	138	2,516	86.7
Orchardgrass							
Benchmark Plus	FFR Cooperative	*624	646	1,066	203	2,539	80.0
Extend	Allied Seed	*476	762	983	151	2,372	71.0
Intensive	Barenbrug USA	497	455	985	nh[1/]	1,937	62.0
Mean		790	626	1,149	576	2,996	78.9
LSD[2/] $_{(0.05)}$		NS[4/]	NS[4/]	NS[4/]	379	1,110	NS
% CV[3/]		50	33	27	53	22	15

1/ = not harvested; 2/ = least significant difference test at 5% level of probability; 3/ = coefficient of variation; 4/ = not significant
*Entries with earliest growth were cut on May 4 and are indicated with an *. Remaining entries were cut on May 9.

FORAGE GRASS MARKETERS WITH REPORTED ENTRIES

Allied Seed
1108 Hilldale Dr
Macon, MO 63552
(800) 880-8127

Barenbrug USA
33477 Hwy. 99E
P.O. Box 239
Tangent, OR 97389
(541)-926-5801

DLF-International Seeds
175 West H Street
P.O. Box 229
Halsey, OR 97348
Phone: (541) 369-2251

FFR Cooperative
4846 East 450 North
Lafayette, IN 47905
(765) 589-3123

Pennington Seed Co.
P.O. Box 290
Madison, GA 30650
Phone: (800) 285-7333

Southern States Cooperative
P.O. Box 26234
Richmond, VA 23260
Phone: (804) 281-1253

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http://Plant-Materials.nrcs.usda.gov
http://www.nrcs.usda.gov

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