



Forage Production of Native Warm-Season Grass Varieties in Beltsville, MD

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Rotational grazing of switchgrass at the University of Maryland Wye Research and Education Center. Example of a managed grazing system (not part of this trial).

INTRODUCTION

Native warm-season grasses used in a rotational grazing system provide valuable summer forage when cool-season grasses are less productive. Native warm-season grasses are very versatile and are used not only for forage and pasture, but for a wide array of uses including wildlife habitat, soil stabilization and biofuels. There are many cultivars, selected ecotypes, and some identified native warm-season grasses available today. We will refer to these collectively as varieties. With the many varieties to choose from and the lack of comparative forage production information for Maryland and other varieties that were not specifically selected for forage production, some varieties that were selected for forage have not been adequately tested in Maryland and other varieties that were not specifically selected for forage may also prove valuable for forage production. To better utilize these grasses, more forage productivity data is needed. This trial is being conducted jointly by NRCS and Maryland Cooperative Extension. The Maryland Grazing Lands Conservation Initiative Coalition helps to fund this project each year.

The objective of this study is to determine the yield by harvest date and season total of warm-season grass varieties when grown in Maryland in a simulated rotational grazing system. Forage production information will help farmers to optimize production in a sustainable manner that will conserve natural resources and benefit their bottom line. Total yield and harvest date growth curve data will be used to refine the grazing models in the C-Graz software that is used in planning and optimizing managed grazing systems.

METHODS

The trial includes 36 varieties of 7 different species (eastern gamagrass, switchgrass, big bluestem, indiangrass, little bluestem, Florida paspalum, and coastal panicgrass). The trial was conducted on Galestown-Ebawton loamy sands, 0-8% slope (available water holding capacity (60 inches) is about 3.7 inches; somewhat excessively drained) at the NRCS National Plant Materials Center located at Beltsville, Maryland. With the exception of eastern gamagrass, varieties were seeded in six-row plots with a 5-inch row spacing using a cone-seeder. Eastern gamagrass varieties were seeded by hand in two 36-inch rows per plot. All varieties were seeded June 16, 2005. Switchgrass, little bluestem and Florida paspalum were seeded at 8 lbs PLS per acre and the other species were planted at 10 lbs PLS per acre, as shown in Table 1. The trial was planted in a randomized complete block design with four replications. Plot size is 3 ft. x 20 ft. with yield measurements taken from the entire plot area. Soil test (10-0-07) values were pH 5.5, P = 111 ppm (very high), and K = 85 ppm (medium). Florida delonchic lime was applied at 1 ton/acre in early May 2006. Nitrogen was applied at a rate of 100 pounds per acre at the beginning each growing season except 2005. Irrigation was only applied during establishment (2005 and 2006) and was not applied in 2007 or 2008. The trial will continue for a minimum of four years (stands permitting) as a simulated grazing system.

The plots were not harvested until 2007 to allow grasses to fully establish. Cuttings are made using a Carter flat-type harvester and cut to a height of 8 inches. Harvesters were made 3 times each growing season on dates indicated in table 2. Harvest material was weighed green in the field and samples were collected for dry matter (DM) determinations from 2 of the 4 replications. Analysis of variance was conducted using the Randomized Complete Block Model from Statistix 8 v 8.2, 2007, Analytical Software, Tallahassee, FL. LSD was used to determine the differences between variety means for each year. Significance was determined for all analysis at the 0.05 probability level.

Stand ratings were recorded to capture information for establishment and persistence. The stand score is a visual estimate of groundcover that is contributed by the planted variety. The stand score scale is from 1 to 100 with 1 equating no plants of the seeded species/variety present and 100 equating complete cover of plants of the seeded variety.

Table 1. Species Used And Seeding Rates

Scientific Name	Common Name	PLS/acre
<i>Andropogon gerardii</i>	big bluestem	10
<i>Panicum alternatum</i> var. <i>alternatum</i>	Coastal Panicgrass	8
<i>Panicum virgatum</i>	switchgrass	8
<i>Paspalum floridanum</i>	Florida paspalum	10
<i>Sporobolus vaginifolius</i>	litle bluestem	8
<i>Sorghastrum nutans</i>	Indiangrass	10
<i>Tripsacum dasyphyllum</i>	eastern gamagrass	10

Figures 1-4. Precipitation

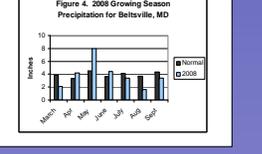
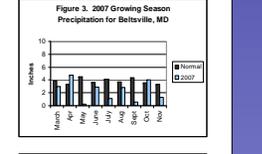
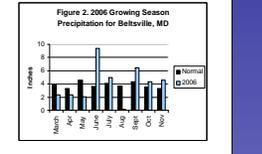
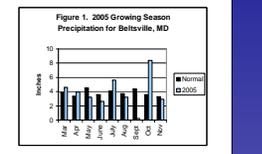


Table 2. Yield Data

Species/Variety	Forage Yield (lb/acre)								Stand (%)	
	2007				2008				6/2307	7/2108
	July 9	Sept. 6	Nov 8	Total	June 6	July 25	Sept. 22	Total		
Eastern Gamagrass										
'Highlander'	2213	999	270	3482	4091	4962	2248	11210	73	91
'Meadowcrest'	1766	937	171	2875	3981	4949	2155	11099	65	99
'Vert'	2001	735	129	2864	4377	4365	2274	11015	60	86
'Ver'	1457	780	140	2377	3942	3839	2079	9861	77	89
Switchgrass										
'Carthage'	6997	2679	115	9790	3417	4204	1844	9964	90	100
'Shawnee'	4285	1974	107	6466	3600	4266	1603	9523	71	96
'Blackwell'	4060	1742	77	5879	3555	4340	1413	9313	76	95
'Cave-in-Rock'	4732	2174	57	6963	3297	4153	1569	9019	75	86
'Kanlow'	5263	2963	78	8303	2322	4399	1007	8632	66	80
'Shiloh'	2207	1345	55	3607	3636	3566	1189	7706	60	87
Florida Paspalum										
Florida Paspalum MD unseeded 9/87/06	3003	2363	307	5672	1209	5657	2188	9053	86	93
Coastal Panicgrass										
'Atlantic'	5894	3360	679	9934	2420	4580	1854	8849	76	79
Indiangrass										
'Vantage'	3190	1203	111	4503	1840	3849	1420	7180	80	93
'NY unseeded P291811'	1337	634	24	1995	2135	3880	1088	7063	79	94
'America'	2674	1600	152	4425	1614	3984	1557	7665	92	91
Southlow Michigan Germplasm										
Southlow Michigan Germplasm	1961	341	11	2314	3240	3240	932	4586	67	86
Southlow Michigan Germplasm	2569	1244	93	3906	1556	3629	1231	6416	89	99
'76:54'	1766	559	61	2386	1802	3287	866	4937	87	96
'Ramsey'	2041	768	61	2870	1720	2977	874	5990	90	85
MD unseeded	1143	588	45	1776	2536	2903	1083	5148	87	90
'Yak'	864	221	48 ¹	1085	1515	2536	775	4821	83	90
Big Bluestem										
'Nagina'	838	306	6	1149	3377	2998	525	6099	77	95
'Sulphur' Michigan Germplasm	1033	944	96	2073	2494	3781	780	6524	76	86
'Bluesong'	1185	530	23	1737	2265	3047	984	6296	82	96
Southlow Michigan Germplasm	643	204	3	849	1718	3449	748	5964	62	85
Little Bluestem										
'Aldous'	1742	624	44	2410	1317	2985	1072	5374	86	86
'Climax'	3279	1234	74	4587	710	2948	992	4449	82	76
'Cango'	1992	542	30	2564	1092	2547	917	4556	81	80
Southlow Michigan Germplasm	849	195	24	1068	1076	2548	609	4234	74	87
Dave Crest Germplasm	603	402	56	1060	1917	2060	606	3983	80	85
'Blair'	2982	275	11	3260	389	2159	181	3852	79	83
Mean	2208	1094	102	3504	2284	2907	1284	7154	78	89
LSD ¹ (ms)	1413	505	95	1705	1240	913	517	2833	16	15
% CV ²	42	33	42	34	39	18	28	20	15	12

¹ Least significant difference test at 5% level of probability; ² coefficient of variation



Harvesting plots, September 22, 2008.

YIELD

Difficult conditions contributed to a prolonged establishment. Ploos experienced heavy weed competition during the seeding year resulting in very little green in 2005. Plots were mowed to 8 inches to suppress weeds. Establishment of the plots largely occurred in 2006 and continued to improve significantly through 2007. The yields in 2007 were impacted by droughty conditions and noticeably stressed the grasses causing significant leaf rolling and reduced growth. Precipitation in 2008 was above average for April, May and June, but below average in July, August, and September. Greater precipitation in 2008 and more mature plots resulted in significantly greater yields.

Summary of yields and stand scores are reported in Table 2. Varieties are grouped according to species and are ranked according to yield performance for 2008.

Yield data from plots with less than 50% stand were not included in the analysis. Varieties that were not included in the data analysis due to consistently poor stands of less than 50% include Southlow Michigan Germplasm switchgrass, Sulphur Michigan little bluestem, 'Kaw' big bluestem and Oz-TU Germplasm big bluestem. Oz-TU Germplasm big bluestem was eliminated due to impure stands resulting from contaminated seed.



Plot establishment 8/16/06. The plots in the foreground from left to right are Florida paspalum, 'Cave in Rock' switchgrass, and 'Ramsey' Indiangrass.

RESULTS AND DISCUSSION

For 2007, the five most productive varieties were 'Atlantic' coastal panicgrass, 'Carthage' switchgrass, 'Kanlow' switchgrass, 'Cave-in-Rock' switchgrass, and 'Shawnee' switchgrass. The three highest yielding varieties in 2007 had similar yields in 2008 despite better rainfall and stand ratings, suggesting a high degree of drought tolerance and little yield response due to increased moisture in 2008. The eastern gamagrass varieties 'Highlander', 'Meadowcrest', and 'Vert' yielded significantly higher than all others in 2008 and had substantially better yield than in 2007. This improved yield at least partly due to the longer establishment period of gamagrass, but may also be due to the increased rainfall. The plots of gamagrass continued to improve through 2008 as the individual clumps grew larger and further filled the plot areas.

The Florida paspalum yielded remarkably well in 2008 considering it is an unimproved collection. The July 25, 2008 yield of Florida paspalum was statistically equal to the highest yielding gamagrass varieties. Since it was well established in 2007 the higher yield in 2008 is likely due to higher rainfall. Of note, Florida paspalum had consistently lower dry matter content. For the July 25, 2008 harvest, Florida paspalum had 17.5% dry matter whereas the other species ranged from 24.1% to 29.7%. Florida paspalum has also exhibited good seedling vigor, stand establishment and weed suppression.

Eastern gamagrass varieties produced greater yields early in the season than other varieties. This early season growth was the major contributor to greater season yield. Eastern gamagrass varieties, Florida paspalum, and coastal panicgrass also continued growth later and had better late season yields than other species.

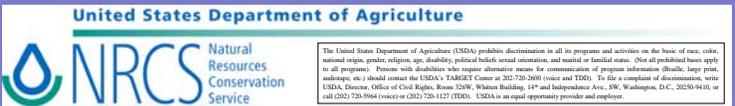
Planned for the future are field size evaluations of the establishment, persistence and palatability of promising varieties/selections under actual rotational grazing management. These studies may be conducted at the University of Maryland Wye Research and Education Center.

CONCLUSIONS

Based on the initial results from this trial, the eastern gamagrass varieties 'Highlander', 'Meadowcrest', and 'Vert' are recommended for high yields when grown in Maryland in a managed grazing system. These varieties also can be grazed earlier and later in the season than other varieties, but require a longer establishment period.

Varieties that have potential to come into production quickly and under dry conditions include 'Carthage' switchgrass, 'Atlantic' coastal panicgrass and 'Kanlow' switchgrass. Florida paspalum has exhibited good vigor, ease of establishment and high yield potential and should be evaluated further.

This trial is ongoing and the results from the first two years of harvest are preliminary. More definitive conclusions will be made after additional data is gathered over the next several years.



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