Biomass Yield, Height, and Other Quality Parameters for Big Bluestem Varieties and Pre-varietal Lines Tested at Three Plant Materials Center Locations in Arkansas, Kansas, and Missouri

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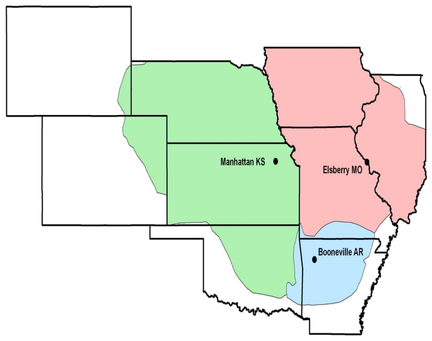

Introduction

Big bluestem (*Andropogon gerardii*) is a warm-season, perennial grass native to the central and southern Great Plains. Big bluestem (BBS) is a major component in many USDA conservation programs throughout the Great Plains. A 3-year common garden study of eleven BBS entries consisting of varieties, pre-varietal selections, and experimental lines of BBS from three central regional Plant Materials Centers (PMCs) was conducted from 2009-2011. Comparative evaluations of the pre-varietal releases and experimental selections from the PMCs are needed to document their performance and site adaptation. The objectives of this study were to compare above-ground biomass yield, biomass quality, persistence of the eleven lines, and to evaluate their performance and adaptation in other geographic, edaphic, and climatic regions.

Methods

Each PMC received seed or ramets of clonal material to produce plants in their respective greenhouse facilities (Table 1) for their own use. Plants were transplanted in the spring of 2008 into randomized plots 9 by 18 feet with individual plants spaced 3 feet apart. Plant heights were measured prior to each forage harvest. The 4 middle plants of the 18-plant plot were harvested and weighed biannually, (Figure 1) at the boot growth stage in the spring and after first frost in the fall. Plants were hand harvested at 8 inches above the soil surface. A grab sample from each plot's total weight was retained and dried to determine dry matter yield for each plot (Figure 2). The plots were maintained, nitrogen fertilized (~60 pounds/acre), and evaluated twice annually from 2009 to 2011 at each of the 3 respective PMCs.

Table 1. Big bluestem selections under test in Inter-Center Strain Trial (ICST)

Name of Release or Accession Number	Origin of Materials	Source of Plant Materials
Hampton Germplasm	AR, MO, and OK	Booneville PMC
OZ-70 Germplasm	AR, MO, and OK	Elsberry PMC
Refuge Germplasm	AR	Elsberry PMC
Northern MO Germplasm	N. MO	Elsberry PMC
9083274	Logan County, AR	Elsberry PMC
483446	SC. Kansas and E. OK	Manhattan PMC
Kaw	Flint Hills KS	Manhattan PMC
Rountree	Monona County, IA	Elsberry PMC
Pawnee	Pawnee County, NE	Stock Seed
Bonanza	Derived from Pawnee	Stock Seed
Goldmine	Derived from Kaw	Sharp Brother's Seed

Figure 1. PMC crew hand harvests 4 big bluestem plants from each plot at 8 inches above the soil surface.

Results

Table 2. Average biomass yield (T/AC) and plant height (IN) over 3 years at all locations.

Entry Name	Arkansas		Missouri		Kansas	
	T/AC	IN	T/AC	IN	T/AC	IN
Hampton	3.43	40	4.14	48	2.99	51
OZ-70	3.41	38	4.65	50	3.30	53
Refuge	1.85	29	3.99	48	2.10	47
Northern MO	2.35	32	5.61	53	2.77	53
9083274	2.99	43	4.28	50	1.96	57
483446	3.48	38	3.51	45	3.04	54
Kaw	3.30	36	3.63	39	3.53	55
Rountree	3.70	39	4.76	53	3.75	57
Pawnee	2.52	34	2.84	42	2.50	49
Bonanza	2.24	34	3.89	43	2.46	54
Goldmine	2.49	34	4.27	48	3.17	54

Biomass quality data collected in Arkansas indicated that there were relatively similar crude protein levels in all the lines with an average of 7% at boot stage. Over the 3-year period, Hampton Germplasm had the highest average crude protein at 8% and Rountree the lowest at 6%. Average Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Total Digestible Nutrients (TDN) were 35%, 64%, and 53%, respectively for all lines. BBS disease and insect resistance were rated very good overall in Arkansas and Missouri, but in Kansas, Bonanza and Goldmine suffered considerable damage from both. Height measurements were varied across locations. Refuge Germplasm, selected for reduced stature, was generally shorter than other lines.

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Results cont.

Table 3. Average annual precipitation (long term) at Arkansas, Missouri, and Kansas test sites and average biomass yield across all lines within the study.

Site Name	Average Annual Precipitation (IN)	Mean Biomass Yield All Lines (T/AC)
Arkansas	47.8	2.89
Missouri	36.4	4.14
Kansas	34.8	2.87

Figure 2. PMC crew weighs total green plot weight and then removes a grab sample to be dried to determine plot dry matter yield.

Discussion

The best yielding line of BBS overall across the three sites was the variety release Rountree (Table 2). It consistently produced a greater quantity of biomass than any other source of BBS in this study, but had the lowest crude protein percentage. The two numbered experimental lines produced similar yields, but the Kansas line (483446) was more consistent across sites in its production totals. The overall poorest biomass producers across sites were the released varieties Pawnee, Bonanza, and Refuge Germplasm. The best site for BBS biomass production was Missouri which yielded a ton more than either Arkansas or Kansas during the 3-year study (Table 3).

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