Biomass Yield and Persistence of Eleven Big Bluestem Sources in the Southern Ozarks

A. A. Jacobs[1], J.R. King[1], T.E. Pratt[1], L.D. Goff[1] and J.L Douglas[2]

[1]USDA-NRCS: Booneville Plant Materials Center, 6883 S. State Highway 23, Booneville, AR 72936

[2]USDA-NRCS: National Technology Support Center, 501 W. Felix St, Fort Worth, TX 76005

USDA NRCS

United States Department of Agriculture
Natural Resources Conservation Service
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Abstract

Livestock producers in northwest Arkansas have increasingly sought out forage species adapted to below-average rainfall amounts and greater than average summer air temperatures. Big bluestem (Andropogon gerardii Vitman), is a native, perennial warm season grass that may allow livestock producers to diversify forage species on their farms. The objectives of this study were to evaluate biomass yield and forage quality of 11 big bluestem sources in the southern Ozark region over a three-year period. 'Rountree', 'OZ-70', Hampton germplasm, 'Epic' 'Kaw', accession 483446, and 'Goldmine' produced the highest total yields. Each of these sources produced over 5.6 Mg ha^{-1} per year and differences among these sources were not significant. Differences in forage quality were not significant in 2009, but were significant in 2010 and 2011. Hampton Germplasm had the highest average crude protein value of 8% over three-years and 'Rountree' has the lowest of 6%. Biomass yield was comparable to other common warm-season forages used in the southern Ozarks, such as common bermudagrass (6.7-11.2 Mg ha-1 per year) (Ball et al., 1996). Results indicate that highest-yielding big bluestem sources are adapted to conditions in the southern Ozarks and may be a viable option for livestock producers as a native warm-season forage.

Table 1. Big Bluestem sources and origins

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	Northern 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

Materials and Methods

Site Description & Design

Eleven sources of big bluestem were established at the Booneville Plant Materials Center (BPMC) in 1.8 m x 2.7 m plots on a Leadvale silt loam in May 2008. Soil was classified as a Fine-silty, silicaceous, thermic Typic Fragiudults (SCS, 1980). Experimental design was a randomized complete block design with four replicates. Plots were irrigated in 2008 for establishment only.

Soil fertilization

Soil phosphorus and potassium were adjusted to recommended values for medium production. Nitrogen fertilizer was applied at a rate of 0.067 Mg ha^{-1} in 2009, and 0.04 Mg ha^{-1} of nitrogen, phosphorus, and potassium was applied annually when plants broke dormancy in April of 2009-2011.

Figure 1. BPMC technicians harvest and collect big bluestem biomass in June 2010.

Materials and Methods

Yield

Yield was collected by manually harvesting twice per year in 2009-2011. The first harvest was collected with 50% of sources reached the late boot stage (when the first seedhead begins to emerge) of growth (this will be referred to as the summer harvest). The second harvest of re-growth was collected after the first killing frost in the fall (this will be referred to as the fall harvest). Yield wasdetermined by sampling four plants from the center of each row at a cutting height of 20 cm. A grab sample was collected from each big bluestem source after the spring harvest and was dried at 60° C for 24 hours and used to calculate dry matter yield. Total annual yield was determined by summing summer and fall harvest yields. Plots were not harvested in fall of 2011 due to lack of plant regrowth.

Forage quality

Forage quality estimates of crude protein (CP), acid detergent fiber (ADF) neutral detergent fiber (NDF) were determined from the summer harvest only. Dried grab samples of sources were ground and analyzed for forage quality. Percent total digestible nutrients (TDN) were estimated using the following equation: % TDN = 73.5+ (0.62 x %CP) –(0.71 x %ADF).

Table 2. Early summer, late fall, and season total production of eleven sources of big bluestem at the Booneville Plant Materials Center from 2009-2011.

	Dry Matter Yield						
	2009			2010			2011
Source	Mg ha^{-1}						
	22-Jun	8-Dec	Total	15-Jun	8-Dec	Total	23-Jun
Hampton	5.0	2.7	7.7	6.1	1.5	7.6	4.4
OZ-70	6.5	2.2	8.7	5.1	1.5	6.6	5.0
Refuge	2.7	1.5	4.2	3.5	0.6	4.1	3.3
9083274	4.8	2.1	6.9	5.3	1.2	6.5	5.4
EPIC	4.6	2.1	6.7	2.5	1.3	3.9	3.6
Rountree	7.6	1.6	9.2	6.2	1.1	7.3	4.3
Kaw	4.4	2.7	7.0	5.8	2.0	7.7	4.4
483446	4.9	3.4	8.4	5.3	1.9	7.2	4.2
Pawnee	3.5	1.8	5.3	5.0	0.9	6.0	4.1
Bonanza	2.6	1.6	4.1	5.0	0.9	5.9	3.8
Goldmine	2.9	1.5	4.4	5.2	1.6	6.8	6.0
Mean	4.5	2.1	6.6	5.0	1.3	6.3	4.4
$LSD_{(0.05)}$	NS†	NS	NS	NS	0.66	NS	1.6

† not significant

Results

Yield

Dry matter yields varied among big bluestem sources, years, and harvest dates (Table 2). Yield was closely tied to rainfall amounts and influenced all big bluestem sources, especially in 2011 due to lack of rainfall in June and July and subsequent lack of measureable regrowth. Yield was greater when harvest occurred in the summer, and regrowth collected in fall was only half the amount of biomass harvested in the summer (Table 2).

In 2009, 'Rountree' and 'OZ-70' produced the greatest numerical yield, while 'Bonanza' and 'Refuge' produced the least numerical yield. However, there were no significant differences in yield between all sources.

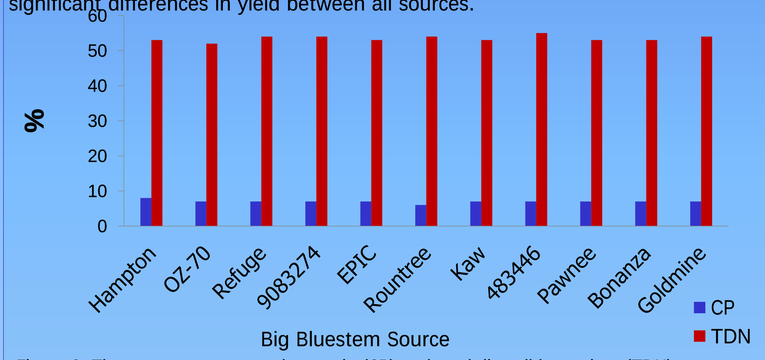

Figure 2. Three-year average crude protein (CP) and total digestible nutrient (TDN) percentages for big bluestem sources from 2009-2011.

Quality

Average forage quality data collected at the boot stage of growth was similar across all sources (data not shown). No significant differences were found between big bluestem sources in 2009. Data from 2010 and 2011 showed significant differences between big bluestem sources, but these differences were of minimal magnitude (nata not shown). Average percent CP was 7, which is slightly below the ranges reported by Ball et al. 1996 for other common warm-season grasses. Common bermudagrass and dallisgrass all have 9-11 percent crude protein (Ball et al., 1996). Over the three-years, Hampton Germplasm had the highest CP of 8%, while Rountree had the lowest average CP of 6%.

Discussion & Recommendations

Overall forage yield and quality of the eleven entries of big bluestem were comparable to other common warm-season forage species grown in the southern Ozarks. Common bermudagrass (*Cynodon dactylon* (L.) Pers.) and dallisgrass (*Paspalum dilatum* Poir.) have 9-11 percent crude protein (Ball et al., 1996). Over the three-years, Hampton Germplasm had the highest CP of 8%, while Rountree had the lowest average CP of 6%.

Hampton Germplasm, OZ-70 Germplasm, 9083274, Rountree, Kaw, and 483446 produced above-average forage production with appreciable forage quality. Two-harvest frequencies showed that it is possible to first harvest the top performing big bluestem sources in the boot stage of growth to utilize as a hay or grazing crop, while stockpiling forage re-growth later in the year. Re-growth could be used for winter grazing or as a standing hay crop. However, forage quality would be greatly decreased compared to the first harvest earlier in the year
This information may be used to update conservation practice specifications for Forage and Biomass Planting (Practice 512) recommendations to include Hampton, OZ-70, 9083274, Rountree, Kaw and 483446 as acceptable big bluestem sources for the southern Ozarks.

References

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