Seed Production Comparison of Three Eastern Gamagrasses in East Texas, Study No: ETPMC-T-0671-PA

Abstract

Two eastern gamagrass [*Tripsacum dactyloides* (L.) L] cultivars, 'Jackson' and 'Medina', and one accession 9043629, (Nacogdoches County, TX) were comparatively evaluated for seed production characteristics and plant morphology in 2007-2009 from a randomized complete block design with three replications at the East Texas Plant Materials Center (ETPMC) on an Attoyac fine sandy loam. The number of vegetative and reproductive tillers were recorded from three random plants within the interior of each plot and reported as a percentage of the tiller type. The number of axillary inflorescences per primary reproductive tillers was also recorded. Seed quality parameters of percent fill, percent germination, and seed yield were also collected from plants within the interior of each plot. Accession 9043629 showed significant increases in the percentage of reproductive tillers/plant, and axillary inflorescences/ reproductive tiller, which resulted in significantly higher seed yield for accession 9043629 compared to the other cultivars. Accession 9043629 will be elevated to release status under the name 'Nacogdoches', and serve as a replacement for Medina and Jackson.

Introduction

Eastern gamagrass is a native warm season perennial adapted throughout most of the eastern United States. The primary use of this plant is as a livestock forage but it has potential as vegetative barriers for controlling erosion on sloping cropland (Ball et al. 2002; Dewald et al. 1996). Low seed production has limited its acceptance in the commercial seed market. The USDA-NRCS ETPMC, Nacogdoches, TX, has released two eastern gamagrass cultivars, Medina and Jackson. A third accession 9043629 was identified as a potential release during initial testing and appeared to have better seed production potential than Medina and Jackson. The objective of this study was to determine if accession 9043629 had equal or superior seed yield and quality compared to Jackson and Medina.

Materials and Methods

The study was conducted at the ETPMC near Nacogdoches, Texas on an Attoyac fine sandy loam. The experimental design was a randomized complete block with three replications. Each plot consisted of 20 plants vegetatively established in a 5 x 4 arrangement on 3 ft centers. Irrigation water was used to accelerate establishment during the first year only. Plots were fertilized with ammonium nitrate (34-0-0) at a rate of 75 lb/acre each spring to ensure adequate fertility for fertile culms and increased seed yields (Wheeler and Hill 1957). Phosphorus and potassium were maintained at a medium to high level according to soil test

recommendation. Weed control was obtained by manual cultivation and spot spraying with a 2% glyphosate solution.

Data was collected from three plants on the interior of each plot to minimize edge effect. Reproductive and vegetative tillers were counted, and seed harvested from 3 plants in each plot. Seed was harvested when approximately 75% of the stamens had dropped from the inflorescence. Seed was hand cleaned to remove anthers, stamens, and other stem material. Seed was allowed to dry at ambient temperature until there was no change in seed weight due to moisture loss. Weight from each plot was then recorded as bulk yield. Bulk seed from each plot was separated into light and heavy seed fractions with a South Dakota Seed Blower. The air flow regulator was 70% open to allow enough air flow through the plastic column to allow for efficient separation of filled and unfilled seed (Ahring and Franks, 1968). Seed from the heavy and light fractions were re-run through the South Dakota Seed Blower and randomly sampled to determine the absence or presence of a mature grain to ensure air flow was effective in separating filled and unfilled seed. The weight of each fraction was recorded and the heaviest fraction was then compared to the bulk weight of the sample to determine the percent fill. Germination tests were conducted on the heavy fraction by stratifying the seed in a cool, 5°C, moist environment for 6 week (Ahring and Franks 1968). Four replicates of 100 seed were then placed in germination boxes and placed in a controlled germination chamber set for 8 hours of light at 30°C and 16 hours of dark at 20° C. Counts were made at 14, 21, 28, and 35 days. Only the 35 day germination percentage is reported in this paper. Evaluation began in the spring of 2007 and ended in the spring of 2010. An analysis of variance was used to determine significant differences in plant morphology and seed production characteristics at the $P<0.05$.

Results and Discussion

There were significant differences in the number of vegetative and reproductive tillers between 9043629, Medina, and Jackson in 2007 and 2008 (Table 1). Accession 9043629 produced a significantly lower percentage of vegetative tillers than Medina and Jackson but a higher percentage of reproductive tillers. This trend was also observed in 2009 but the increase tiller production was not significant. Previous work has shown the increased number of reproductive tillers and fewer

Figure 1. Top to Bottom, Nacogdoches, 'Jackson', 'Medina' showing varying degrees of rust infection, USDA-NRCS ETPMC

Figure 2. Medina, seen left and front, was visually stunted during the 2008 growing season compared to surrounding 'Jackson' and Nacogdoches plots, USDA-NRCS ETPMC

vegetative tillers had no adverse effect on the forage quality of 9043629 compared to Medina and Jackson (Table 2). Accession 9043629 had significantly more axillary seed heads along its reproductive tillers in 2008, and though not significant, this trend was also noted in 2007 and 2009 (Table 1).

It was also noted in 2007 that Jackson and 9043629 were less affected by the rust pathogen, *Puccinia tripsaci*. Medina was heavily infected during the 2007 growing season (Figure 1). Medina was visually stunted at the beginning of the 2008 growing season (Figure 2), and was the last cultivar to mature in 2008. In contrast, it was the earliest maturing cultivar in 2007 and 2009. The heavy rust infection could account for the decrease in its performance and productivity during the 2008 growing season (Handley et al. 1990).

Table 1: Vegetative and Reproductive Tiller Analysis of Three Eastern Gamagrass Cultivars in 2007-2009, USDA-NRCS Nacogdoches, TX.

Gamagrass Source	Vegetative			Reproductive			Axillary Seed Heads		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
	----------% per plot----------						--Average No/Plant--		
9043629	63 c*	57 b	59 a	37 a	43 a	41 a	3.9 a	5.5 a	3.6 a
Jackson	82 a	81 a	72 a	18 c	21 b	28 a	2.9 a	3.1 b	2.9 a
Medina	75 b	95 a	70 a	25 b	5 b	30 a	2.5 a	2.1 c	2.7 a

*Means followed by the same letter are not significantly different at P<0.05.

Table 2: Average Forage Quality Comparisons of 9043629 and Eastern Gamagrass Cultivars Harvested on 45 day clipping frequency and fertilized with 120 lb/acre N (adapted from Brakie, 1998).

Gamagrass source	Forage Quality CP[1/]	TDN[2/]
	----------%----------	
9043629	9 a[3/]	56 a
Jackson	8 a	56 a
Medina	8 a	56 a

[1/] crude protein; [2/] total digestible nutrients; [3/]means in columns followed by the same letter are not significantly different at P<0.05.

Accession 9043629 significantly increased seed yield in 2008 and 2009 as compared to Jackson and Medina but the increase was not significant in 2007. This increase in seed yield would be expected because of the higher percentage of reproductive tillers (Table 1), which would result in more primary and axillary inflorescences; thus, greater seed yields. Seed fill is an indication of seed quality. The higher the percent fill the greater the potential for better and more uniform plant stands. Accession 9043629 had a higher percentage of filled seed as compared to Medina and Jackson but the increase was not significant (Table 3). Differences in

germination were significant in 2008 and 2009, with 9043629 having greater seed germination (Table 3). Only filled seed was used in the germination test due to the earlier separation; the increase in germination suggests less seed dormancy in 9043629 compared to Jackson and Medina. Less dormancy would aid in the rapid establishments of plantings.

The higher seed yields reported for accession 9043629 in this study also agrees with yields from seed production fields at the PMC of 9043629 and Medina at the ETPMC in 2007- 2009. Production field of 9043629 produced greater than three times the yield of Medina in 2007-2009. Medina production field produced 30, 50, and 18 lb/acre, respectively between 2007 and 2009, while 9043629 produced 98, 176, and 60 lb/acre, respectively during the same period. Jackson production fields were not harvested during this time frame.

Table 3: Seed Yield, Fill, and Germination Percentage of Three Eastern Grass Cultivars in 2007-2009, USDA-NRCS, Nacogdoches, TX.

Gamagrass Source	Yield			Fill			Germination		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
	----------g/plot----------			----------%----------					
9043629	159a*	408 a	224 a	82 a	90 a	76 a	54 a	65 a	38 a
Jackson	106 a	151 b	59 c	73 a	76 a	55 a	72 a	46 b	19 b
Medina	78 a	29 c	139 b	84 a	84 a	65 a	62 a	58 ab	31 a

*Means followed by same letter are not significantly different at P<0.05; [2/]

Summary and Conclusion

Accession 9043629 had greater seed yield potential than Jackson and Medina. This is evident by the significant increase in the number of reproductive tillers and the number of axillary seed heads per reproductive tiller. These attributes contribute to the differences in yield seen in the study and production fields at the ETPMC. Seed quality of 9043629 was also slightly better than Medina and Jackson as seen by the differences in seed germination and fill. Increased germination percentage aids in rapid establishment and suggests less seed dormancy in 9043629 when compared to Medina and Jackson. Visual observations during the study also suggested 9043629 was less susceptible to infection from the fungal pathogen, *Puccinia tripsaci.* Further work would be needed to determine the amount of seed dormancy and disease resistance associated with 9043629 compared to other cultivars of eastern gamagrass. Due to its increased seed production 9043629 will be raised to cultivar status and released by the ETPMC under the name 'Nacogdoches' in 2011.

References:

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