Influence of Harvesting Management on Regrowth Performance and Nutritive Value of Eastern Gamagrass (*Tripsacum dactyloides* L.)

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Story in Brief

Yield and nutritive value of regrowth from a 2-yr old stand of 'Pete' eastern gamagrass (EGG) (*Tripsacum dactyloides* L.) were evaluated at the University of Arkansas Forage Research Farm in Fayetteville. Forage samples were harvested at 2-wk intervals beginning on July 11, 2001. Measurements were taken on the regrowth at cutting intervals of 4-, 6-, 8-, and 10-wk after initial harvest. From wk 4 to 10, plant height, number of tillers, and yield of dry matter (DM) increased. Dry matter yields were 1,098, 2,172, 3,848, and 5,470 lb/acre on wk 4, 6, 8, and 10, respectively. There was an increase in concentration of neutral detergent fiber (NDF) and acid detergent fiber (ADF) from 61.1 to 71.4% and from 29.6 to 37.0%, from wk 4 and 10, respectively. Acid detergent lignin (ADL), hemicellulose (HEM), and cellulose (CELL) increased from 7.4 to 10.2, 31.5 to 34.4 and 22.2 to 26.8%, respectively. Crude protein (CP) concentration decreased over time from 16.1, 12.4, 8.2, to 7.8% after 4, 6, 8, and 10 wk of regrowth, respectively. More studies are required to evaluate the optimum time for harvesting EGG.

Introduction

Eastern gamagrass (EGG) is a native, perennial, warm season bunch grass that is native to the eastern half of the United States. The EGG cultivar 'Pete' was developed from 70 accessions originating from native EGG populations in Kansas and Oklahoma (Fine et al., 1990). Productivity and quality of EGG has been studied (Burns et al., 1992). Brejda et al. (1996) reported that EGG produced abundant regrowth following defoliation, and this allows multiple harvests during the growing season.

There are few studies reported on intensity of EGG defoliation. A recommended minimum stubble height is 6 to 8 in. This is simple to maintain during hay production; however, under grazing conditions a higher stubble height is recommended (Gillen, 2001). Chemical composition of EGG regrowth clipped at 56 d following clipping at boot stage has been studied (Coblentz et al., 1998). Concentrations of NDF, ADF, ADL and CP were 77.2, 44.4, 5.1 and 8.2% respectively. In northern Missouri, Brejda et al. (1996) reported on the response of EGG to different harvesting intervals and nitrogen rates. Total forage yield was greater with the 42-d harvest interval than for the 28-d interval. However, the concentration of CP in regrowth was greater with the 28-d than 42-d harvest interval. They suggested that the decision to harvest at 28 or 42 d intervals depends on the objectives of the forage producer. They also suggested that harvesting at 28 d intervals during a year with drought stress reduced plant vigor during the following harvest and season. Rest periods of 28 to 45 d for EGG have been recommended under rotational stocking (Gillen, 2001). However there is evidence indicating that a 28-d rest period is not enough to maintain vigor. Plants clipped at 6 to 8 in at the early heading stage of growth followed by 28- to 42-d clipping intervals lost vigor and after 3 yr were almost dead (Fick and Coblentz, 1994). Brakie (1998) reported increases in EGG yields with longer harvesting intervals. Yields were 8,640, 10,700, and 13,240 lb/acre of EGG harvested at 30, 45, or 60 d intervals after the first harvest. The objective of this study was to evaluate the regrowth performance and nutritive value of a 2-yr old stand of 'Pete' EGG.

Experimental Procedures

A hay plot of EGG was established in rows spaced 40-in apart during spring 1999. The experimental site was fertilized on April 27, 2001 with poultry litter at 2 T/acre. The plot was divided into four blocks with eight rows. After hay cutting by a mower on June 13, 2001 stubble height was 8 in; EGG hay was harvested at heading stage. Regrowth sampling was initiated on July 11, 2001 (4 wk later). Forages were harvested by hand-clipping 39 in of each row at an 8-in stubble height with a hedge cutter. On each harvest date, the height of EGG was established by measuring the tallest plants within each 39-in section of rows that were sampled on that date. Harvest dates were July 11, July 25, August 8, and August 22. Harvest intervals were 28, 42, 56, and 70 d. Harvested samples were dried to a constant dry weight under forced air at 122°F.

Dried whole-plant samples were ground through a 1-mm screen in a Wiley mill (Arthur H. Thomas, Philadelphia). Whole plant concentration of NDF, ADF, and ADL were sequentially determined using batch procedures outlined by ANKOM Technology Corp. (Fairport, NY). Crude protein was calculated from the percentage of N in each sample, as determined by a modified Kjeldahl procedure (Kjeltech Auto 1030 Analyzer, Tecator, Inc., Herndon, VA).

Analysis of variance (PROC ANOVA; SAS Inst., Inc., Cary. NC) was used to analyze yield, height, and tillers response over ten harvest dates. For each individual harvesting date, regression analysis (PROC REG) was used to analyze chemical concentrations (NDF, ADF, ADL, HEM, CELL, and CP) for linear, quadratic, and cubic responses.

Results and Discussion

Plant height and tiller density of EGG regrowth increased ($P < 0.05$) with cutting interval. Plant height increased ($P < 0.05$) from 39.5 to 74.9 in between 28 and 70 d, respectively. Tiller counts at 28 and 70 d were 1.0 and 40.2 tillers/ft^2, respectively (Table 1). The number of tillers and the overall trend toward greatly increased tiller density was highest between 42 and 56 d of regrowth.

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Yields of DM increased ($P < 0.05$) with the length of harvesting interval. Yields ranged from 1,098 to 5,470 lb/acre on 28 and 70 d, respectively (Table 1). These yields of EGG regrowth were within ranges commonly reported in other studies.

Chemical composition of whole-plant EGG regrowth is shown in Table 2.

Concentrations of NDF and ADF increased over time from 61.1 to 71.4%, and 29.6 to 37.0%, respectively. In this study, the concentration of NDF and ADF of EGG regrowth harvested after 56-d interval was lower than that reported by Coblentz et al. (1998). In that study, EGG regrowth was harvested following clipping at boot stage, but in the present study EGG regrowth was harvested following hay cutting at the heading stage. Both HEM and CELL concentrations at 56 d were lower in this study compared to values reported by Coblentz et al. (1998).

Fiber composition of whole plant EGG regrowth is described by the following equations:

Whole plant NDF = 55.6375 + 7.287 (d) – 2.1462 (d) 2 + 0.3279 (d) 3; $R^2 = 0.99$; RMSE = 0.28.

Whole plant ADF = 27.48 + 2.35929 (d); $R^2 = 0.95$; RMSE = 0.62.

Whole plant ADL = 5.0031 + 2.9606 (d) – 0.4168 (d) 2; $R^2 = 0.95$; RMSE = 0.25.

Crude protein decreased from 16.1, to 7.8% for regrowth harvested after 4 to 10 wk, respectively, and can be explained by the following equation:

Whole plant CP = 14.96 + 5.07 (d) – 4.62 (d) 2 + 0.73 (d) 3; $R^2 = 0.99$; RMSE = 0.17.

The CP concentration of EGG regrowth harvested at 56 d interval was consistent with findings reported by Coblentz et al. (1998). In that study the concentration of CP was 8.2%, which was the same as we found in this study.

Implications

The nutritive value and yield of DM observed in this study is comparable to other reported research work. The yield of DM increased with an increase in cutting interval; however, the CP concentration decreased as the cutting interval was increased. The concentration of CP was higher at wk 4 and 6 cutting intervals than on the other harvest dates. More work is required to determine the optimum harvesting time and to evaluate the regrowth performance and nutritive value of EGG harvested at different cutting intervals.

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Table 1. Growth performance and yield of eastern gama-grass regrowth harvested from July 11, to August 22, 2001

Date	Weeks	Height, in	Tillers/ft^2	Yield, lb/acre
7/11/01	4	39.5^d	1.0^d	1,098^d
7/25/01	6	45.3^c	1.3^c	2,172^c
8/08/01	8	70.8^b	31.3^b	3,848^b
8/22/01	10	74.9^a	40.2^a	5,470^a

^{a,b,c,d,} Means in a column without a common superscript differ ($P < 0.05$).

Table 2. Chemical concentration1 (%) of whole plant eastern gamagrass regrowth harvested from July 11 to August 22, 2001

Date	Weeks	NDF	ADF	ADL	HEM	CELL	CP
7/11/01	4	61.1^c	29.6^a	7.5^a	31.4^a	22.2^a	16.1^c
7/25/01	6	64.2	32.7	9.5	31.6	23.2	12.4
8/08/01	8	67.0	34.2	9.9	32.8	24.3	8.2
8/22/01	10	71.4	37.0	10.2	34.4	26.8	7.8

[1]NDF = neutral detergent fiber, ADF = acid detergent fiber, ADL = acid detergent lignin, HEM = hemicelluloses, CELL = cellu lose, CP = crude protein.

[a]Linear effect ($P < 0.01$) with increase harvesting interval.

[b]Quadratic effect ($P < 0.01$) with increase harvesting interval.

[c]Cubic effect ($P < 0.01$) with increase harvesting interval.