Production of grazed tropical grasses at Toa Baja in the humid northern coastal plains of Puerto Rico[1]

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ABSTRACT

A field experiment was conducted on a private farm near Toa Baja in the humid northern coastal plains of Puerto Rico to evaluate the production and persistence of 12 tropical grasses, *Cynodon nlemfuensis* var. *nlemfuensis* Star, *C. dactylon* Coastcross-1, *Brachiaria brizantha* Signal, *B. ruzuziensis* Congo PR PI 5366 and 11716, *C. dactylon* Toño, *Eriochloa polystachya* Carib, *C. plectostachyus* Star, *Digitaria decumbens* Transvala, *C. plectostachyus* Star, *B. radicans* Tanner and *Panicum maximum* Makueni under grazing at 3- to 5-week intervals for 2 years. Average production per grazing period, 1.59 and 1.52 ton/ha, respectively, was not significantly different (P=0.05) among species and cultivars in either year. Forage production in December and May was low compared to that of other periods. This difference might have been associated with low rainfall in December 1983 and April 1984. Lower production in October and early November, 1984, was due to unusually low rainfall that year. Differences in relative palatability of the large number of species and cultivars, and the low grazing pressure at which they were evaluated might explain the lack of significant differences in the performance of these grasses. These variables must be taken into consideration in the design of future experiments for better interpretation of the results.

INTRODUCTION

Cynodon nlemfuensis var. *nlemfuensis* cv. Star PR PI 2341, *C. plectostachyus* Star PR PI 11212 and PR PI 11487 have been reported as highly productive grasses under cutting in different trials in the humid regions of Puerto Rico (10, 13, 17, 19). *C. dactylon* Coastcross-1 and the local cultivar Toño have also been highly productive in agronomic evaluations in the humid northern coastal plains (14). *C. nlemfuensis* produced yields comparable to those obtained in grazing trials (7). Its forage quality, in terms of yields of total digestible nutrients, crude protein content and animal production on intensively managed systems under grazing have made it one of the best compared with other grasses in the region (2, 3, 4, 5). However, *C. plectostachyus* and *C. dactylon* Coastcross-1

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have not been persistent for more than 2 years when managed intensively under clipping or grazing conditions (7, 14).

Brachiaria brizantha Signal PR PI 1525 and *B. ruziziensis* Congo PR PI 5366 and 11716 are highly productive grasses well adapted to the humid regions of Puerto Rico (9, 12). Their forage production has been found to be comparable to that of *C. nlemfuensis* Star and *Digitaria decumbens* Pangola when managed intensively under clipping management (10, 13). The forage quality of *B. brizantha* Signal and *B. ruziziensis* Congo ranked among the best under cutting, even compared with that of Pangola and Star (1, 6). In a grazing trial in the humid region the animal production of *B. ruziziensis* Congo was not significantly different from that of Pangola or Star grass at a fixed stocking rate of 5 head/ha; however, Star grass was more productive when the stocking rates were varied according to forage growth (5). *B. radicans* Tanner USDA PI 299499 is also a highly productive grass compared with Pangola, Congo and Signal (11), but it is not recommended for grazing because of toxicity problems among growing heifers (21).

Eriochloa polystachya Carib did not respond well to two rates of fertilizer when compared to other improved grasses in the humid region (18) and its persistance under grazing has not been reported in the literature in Puerto Rico. *D. decumbens* Transvala PR PI 6349 has been reported as a highly productive grass under clipping (14) and persistent under grazing (16). *Panicum maximum* Makueni PR PI 12917 is a very promising grass highly productive and persistent under grazing in small plots in the humid regions (15, 16). The animal production of these three grasses has yet to be evaluated in grazing trials.

The objectives of the present investigation was to compare the forage production and persistence of these outstanding grasses under grazing in small plots in the humid northern coastal plains of Puerto Rico.

MATERIALS AND METHODS

The experiment was conducted on a private farm located near Toa Baja, lat. 18° 26′ N and long. 66° 16′ W, at an elevation of 10 m, in the humid northern coastal plains of Puerto Rico. Mean annual rainfall is 1,687 mm, well distributed throughout the year, and a mean daily temperature is 20° C, with seasonal variations of about 4° C.

The soil is a Toa silty clay loam (Fluventic Hapludolls), average pH 6.5, 214 p/m available P (Bray 1) and 700 p/m exchangeable K, in the top 20 cm.

A randomized complete block design with four replications and twelve grass cultivars (table 1) in 7.6×7.6 m plots was established April 1983, with vegetative material. They were fertilized with commercial fertilizer 15-5-10 at a rate of 1,344 kg/ha/year divided into four equal applications.

TABLE 1.—*Identification of grass cultivars*

Grass number	Species	SDA PI[1]	PR PI[2]
1	*Cynodon nlemfuensis* var. *nlemfuensis* cv. Star	—	2341
2	*C. dactylon* cv. Coastcross-1	255455	11504
3	*Brachiaria brizantha* cv. Signal	—	1525
4	*B. ruzuziensis* cv. Congo	247404	5366
5	*B. ruziziensis* cv. Congo	338221	11716
6	*C., dactylon* cv. Toño	293611	11212
7	*Eriochloa polystachya* cv. Carib	—	—
8	*C. plectostachyus* cv. Star	409748	13399
9	*Digitaria decumbens* cv. Transvala	299752	6439
10	*C. plectostachyus* cv. Star	341818	11487
11	*Brachiaria radicans* cv. Tanner	299499	—
12	*Panicum maximum* cv. Makueni	349676	12917

[1] United States Department of Agriculture plant introduction number.
[2] University of Puerto Rico Agricultural Experiment Station plant introduction number.

All plots were grazed at 3- to 5-week intervals by a group of 170 cows for 2 to 3 hours. The forage availability in each plot was determined by sampling before and after grazing following the pair quadrats method described by Rivera and Rodríguez (7). Green forage was weighed in the field and samples were taken and dried at 55° C in a forced air oven for 48 hours to determine dry matter content. Grazing started August 23, 1983, and the procedure was repeated for 2 consecutive years. Information for 13 grazing dates was tabulated for each year.

RESULTS AND DISCUSSION

Average production per grazing period in the first year of the experiment, 1.59 ton/ha, was not significantly different (P=0.05) among species and cultivars (table 2). Forage production in December and May was low compared to that of other periods (fig. 1). This decrease might have been associated with low rainfall during December 1983 and April 1984, which was not normal for the region (table 3).

Again, during the second year of experiment there were no signficant differences (P=0.05) between species and cultivars, and the average forage production, 1.52 ton/ha, (table 4) was very similar to first year results. Production in October and early November 1984, was lower compared to that of other periods because of unusually low rainfall (table 3).

Low forage production in January through March is associated with cool temperatures and short days in the humid regions of Puerto Rico (20). This has been observed in previous experiments under grazing in the region (15, 16). In 1984 the production of all grasses during this period was unusually high (fig. 1) but it was lower in 1985 (table 4).

TABLE 2.—*Mean dry forage on offer of tropical grasses under grazing at Toa Baja in the humid northern coastal plains of Puerto Rico, 1983-1984*

Grass number	Grazing dates													Mean per grazing	Total per year
	Aug. 22 1983	Sept. 20 1983	Oct. 21 1983	Nov. 10 1983	Dec. 2 1983	Dec. 20 1983	Jan. 27 1984	Feb. 28 1984	Apr. 5 1984	May 4 1984	Jun. 5 1984	Jul. 13 1984	Aug. 10 1984		
							ton/ha								
7	1.54 n.s.[1]	2.70 ab	1.80 a	1.19 abc	1.75 ab	0.37 ab	2.09 ab	3.60 a	3.92 a	0.39 n.s.	0.94 ab	1.67 n.s.	1.82 n.s.	1.83 n.s.	24.05 n.s.
6	1.50 n.s.	2.15 ab	1.20 ab	1.17 abc	2.14 a	0.52 ab	2.12 ab	3.02 ab	3.96 a	0.51 n.s.	1.33 ab	1.43 n.s.	1.73 n.s.	1.75 n.s.	22.78 n.s.
3	1.46 n.s.	2.28 ab	1.45 ab	0.80 cd	1.50 ab	0.52 ab	2.13 ab	2.33 abc	3.29 abc	0.30 n.s.	1.01 ab	1.96 n.s.	2.66 n.s.	1.67 n.s.	21.71 n.s.
8	1.42 n.s.	1.82 ab	0.46 b	0.78 cd	1.96 ab	0.74 ab	2.39 ab	3.05 ab	3.65 ab	0.71 n.s.	2.43 a	2.34 n.s.	2.29 n.s.	1.85 n.s.	24.06 n.s.
5	1.39 n.s.	2.42 ab	1.30 ab	0.94 bcd	1.00 b	0.59 ab	1.49 ab	1.21 c	3.31 abc	0.47 n.s.	0.90 ab	1.77 n.s.	1.43 n.s.	1.40 n.s.	18.23 n.s.
2	1.37 n.s.	1.11 b	1.43 ab	1.10 abc	1.92 ab	0.32 ab	2.18 ab	3.11 ab	2.71 abc	0.35 n.s.	1.45 ab	1.51 n.s.	1.71 n.s.	1.56 n.s.	20.26 n.s.
9	1.29 n.s.	1.38 b	1.37 ab	0.69 cd	1.58 ab	0.35 ab	2.23 ab	2.24 abc	1.39 d	0.52 n.s.	0.90 ab	1.13 n.s.	1.79 n.s.	1.30 n.s.	16.86 n.s.
10	1.13 n.s.	2.08 ab	0.76 b	0.29 d	1.97 ab	0.66 ab	2.62 ab	2.08 bc	3.07 abc	0.64 n.s.	0.84 ab	1.07 n.s.	1.89 n.s.	1.47 n.s.	19.10 n.s.
12	1.10 n.s.	3.30 a	1.80 a	1.78 a	1.16 ab	0.52 ab	3.10 a	1.94 bc	1.64 cd	1.30 n.s.	2.39 a	1.57 n.s.	1.15 n.s.	1.75 n.s.	22.74 n.s.
11	0.99 n.s.	2.39 ab	1.36 ab	1.63 ab	1.53 ab	0.87 ab	2.60 ab	2.35 abc	2.65 abc	0.41 n.s.	1.14 ab	0.89 n.s.	2.48 n.s.	1.64 n.s.	21.28 n.s.
1	0.74 ns.a	1.29 b	0.80 ab	1.24 abc	1.60 ab	0.94 a	2.80 ab	2.84 ab	3.25 abc	0.24 n.s.	0.55 b	1.43 n.s.	1.79 n.s.	1.50 n.s.	19.49 n.s.
4	0.41 n.s.	3.06 a	1.24 ab	1.35 abc	0.94 b	0.30 b	1.96 ab	1.88 bc	1.98 bcd	0.35 n.s.	0.64 b	1.48 n.s.	1.89 n.s.	1.34 n.s.	17.46 n.s.
Mean	1.19	2.16	1.25	1.08	1.59	0.56	2.31	2.47	2.90	0.51	1.21	1.52	1.89	1.59	20.65

[1]Means in the same column followed by the same letter do not differ significantly at the 5% probability level.

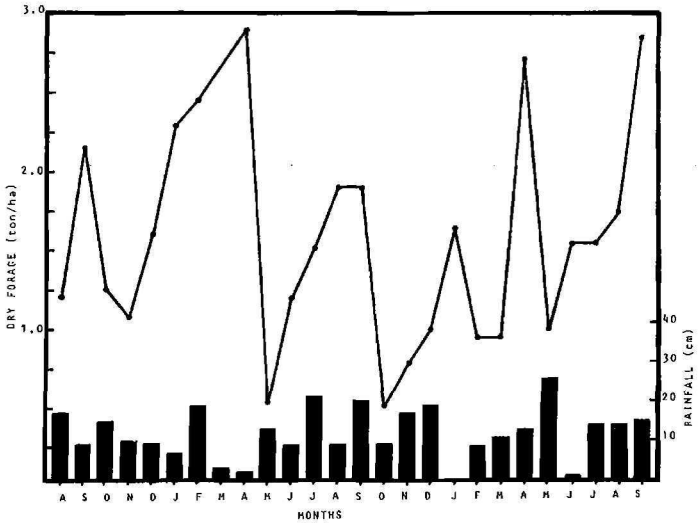

FIG. 1.—Seasonal dry forage on offer, mean for all grasses, grazed in small plots every 5 to 7 weeks at Corozal, Puerto Rico, 1981 to 1983.

Differences in air temperatures might occur from one year to the next, a variable which has to be taken into consideration in the management of these species under intensive management conditions.

The methodology in this experiment was modified from previous grazing experiments in small plots (15, 16), and the grazing pressure was not

TABLE 3.—*Monthly rainfall at Toa Baja during the course of the experiment, 1983-1985*

Month	1983	1984	1985
		mm	
January	16	71	—
February	11	196	82
March	87	32	112
April	335	11	126
May	186	130	259
June	202	90	13
July	146	215	142
August	170	92	137
September	90	199	150
October	144	96	445
November	105	165	—
December	96	184	—
Total	1,460	1,481	—

TABLE 4.—*Mean dry forage on offer of tropical grasses under grazing in Toa Baja in the humid northern coastal plains of Puerto Rico, 1984-1985*

Grass number	Grazing dates													Mean per grazing	Total per year
	Sept. 14 1984	Oct. 11 1984	Nov. 8 1984	Dec. 6 1984	Jan. 10 1985	Feb. 13 1985	Mar. 20 1985	Apr. 19 1985	May. 24 1985	Jun. 14 1985	Jul. 9 1985	Aug. 13 1985	Sep. 12 1985		
	ton/ha														
8	3.07 a[1]	0.47 n.s.	0.27 c	1.12 ab	1.91 ab	0.89 ab	1.18 ab	4.18 a	1.27 a	1.30 n.s.	1.96 n.s.	1.70 ab	2.13 ab	1.65 n.s.	21.40 a
1	2.62 ab	0.30 n.s.	0.48 bc	1.04 ab	1.59 bc	1.14 ab	0.80 b	3.39 ab	1.24 a	1.75 n.s.	1.06 n.s.	1.39 ab	2.26 ab	1.47 n.s.	19.05 a
6	2.16 abc	0.23 n.s.	0.48 bc	0.94 ab	1.90 ab	1.04 ab	0.75 b	3.07 ab	1.30 a	1.59 n.s.	1.51 n.s.	1.90 ab	3.13 a	1.54 n.s.	20.00 a
4	2.15 abc	0.38 n.s.	0.75 bc	0.41 b	1.92 ab	0.88 ab	0.78 b	1.55 b	0.74 a	1.48 n.s.	1.18 n.s.	1.73 ab	3.91 a	1.37 n.s.	17.86 a
11	1.94 abc	0.47 n.s.	1.28 ab	1.70 a	2.29 ab	0.82 ab	1.96 a	3.25 ab	1.21 a	2.12 n.s.	0.85 n.s.	1.96 ab	3.06 a	1.76 n.s.	22.92 a
10	1.74 abc	0.28 n.s.	0.53 bc	1.48 ab	1.33 bc	0.85 ab	0.45 b	2.24 ab	1.03 a	1.69 n.s.	1.39 n.s.	1.35 ab	3.39 a	1.37 n.s.	17.75 a
7	1.67 abc	0.40 n.s.	1.00 abc	1.71 a	2.86 a	1.78 a	1.41 ab	2.75 ab	1.04 ab	0.79 n.s.	2.08 n.s.	2.39 ab	2.75 ab	1.74 n.s.	22.62 a
5	1.63 abc	0.64 n.s.	1.05 abc	0.42 b	1.35 bc	0.99 ab	0.86 ab	2.85 ab	1.57 a	2.04 n.s.	1.30 n.s.	1.32 b	3.14 a	1.47 n.s.	19.16 a
3	1.63 abc	0.67 n.s.	0.85 abc	0.57 b	0.84 c	0.87 ab	1.08 ab	1.91 ab	1.09 a	1.87 n.s.	1.96 n.s.	1.96 ab	3.51 a	1.45 n.s.	18.81 a
12	1.61 bc	1.06 n.s.	1.60 a	1.57 ab	0.88 c	1.41 ab	1.33 ab	1.99 ab	0.71 a	1.77 n.s.	2.23 n.s.	2.81 a	3.12 a	1.70 n.s.	22.10 a
2	1.50 bc	0.56 n.s.	0.85 abc	0.81 ab	2.19 ab	0.45 b	0.54 b	3.92 ab	0.63 a	1.59 n.s.	2.02 n.s.	1.29 b	2.98 a	1.48 n.s.	19.34 a
9	1.01 c	0.36 n.s.	0.43 c	0.34 b	0.76 c	0.30 b	0.36 b	1.54 b	0.40 a	0.65 n.s.	1.16 n.s.	1.14 b	0.67 a	0.70 n.s.	9.13 b
Mean	1.89	0.49	0.80	1.01	1.65	0.95	0.95	2.72	1.02	1.55	1.56	1.74	2.84	1.52	19.18

[1] Means in the same column followed by the same letter do not differ significantly at the 5% probability level.

high enough, as recommended before (8), to graze the plots for 1 to 2 days to a height of 15 cm from the ground. The differences in relative palatability of a large number of species and cultivars and the low grazing pressure at which they were evaluated might explain the lack of significant differences in the performance of the grasses in the present experiment. These variables must be taken into consideration in the design of future experiments for better interpretation of the results.

RESUMEN

Producción de gramíneas tropicales pastadas en las llanuras húmedas de Toa Baja en la costa norte de Puerto Rico

En abril de 1983 se estableció un experimento en una finca privada cerca de Toa Baja en las llanuras húmedas de la costa norte de Puerto Rico para determinar la producción de forraje y la persistencia en parcelas pequeñas de gramíneas tropicales. *Cynodon nlemfuensis* var. *nlemfuensis* Star, *C. dactylon* Coastcross-1, *Brachiaria brizantha* Signal, *B. ruzuziensis* Congo, *C. dactylon* Toño, *Eriochloa polystachya* Carib, *C. plectostachyus* Star, *Digitaria decumbens* Transvala, *Brachiaria radicans* Tanner and *Panicum maximum* Makueni se pastaron a intervalos de 3 a 5 semanas con un grupo de 170 vacas por período de 2 a 3 horas. La producción media de forraje por período fue 1.59 y 1.52 ton./ha. para el primero y segundo años de estudio, respectivamente, sin que arrojaran diferencias significativas (P=0.05) entre especies y cultivares. La produción de forrajes estuvo relacionada con la distribución de las lluvias, las cuales fueron relativamente bajas durante diciembre de 1983 y abril, octubre y noviembre de 1984, lo cual no es normal en la región. La producción de forraje durante los meses de temperaturas frescas y días cortos de enero a marzo fué alta en todas las forrajeras en 1984 y baja en 1985, tal como se ha observado antes en otros experimentos de pacedura en la región. Esto indica variaciones en temperaturas de un año a otro que deben tomarse en consideración en el cultivo intensivo de estas forrajeras. Por otro lado, la metodología utilizada en este experimento fue modificada de manera que la presión de apacentamiento fue menor, lo cual pudo haber influido en los resultados al examinar numerosas especies y cultivares con una palatabilidad relativa muy diferente. Esto debe tomarse en consideración en el diseño de este tipo de experimentos en el futuro.

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