Effect of Three Grazing Intervals on Carrying Capacity and Weight Gains Produced by Star Grass Pastures[1, 2]

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ABSTRACT

Intensively managed well fertilized Star grass pastures on a steep Ultisol produced similar weight gains and yields of total digestible nutrients (TDN) and of dry forage with similar protein contents when grazed at 14-, 21-, and 28-day intervals over 3 consecutive years. Average weight gains were 1,197 kg/ha/yr; TDN yields were 7,699 kg/ha/yr; dry forage consumed by the grazing animals was 12,930 kg/ha/yr; and carrying capacity was 5.3 273-kg steers/ha. The forage contained an average of 16.8% crude protein and had an apparent digestibility of 62.7%.

Average monthly weight gains varied considerably throughout the year but were apprently not related to rainfall (fig. 1).

These data show that Star grass pastures can be grazed at intervals varying from 14 to 28 days without affecting their productivity provided that they are grazed no closer than about 20 cm from the ground and that they are well fertilized. Grazing no closer than 20 cm leaves sufficient photosynthetic area and enough root reserves are maintained to ensure rapid regrowth of the grass after grazing.

INTRODUCTION

Star grass (*Cynodon nlemfuensis*) is rapidly becoming the most widely planted pasture grass in the humid region of Puerto Rico. Caro-Costas and Vincent-Chandler (4) found that Star grass pastures responded, in terms of beef production and carrying capacity, to applications of up to 3,180 kg of a 15-5-10 fertilizer/ha/yr. Caro-Costas and Vincente-Chandler (3) found that Star grass pastures outyielded those of Pangola grass, producing over 1,500 kg/ha/yr of gain in liveweight when fertilized with 2,270 kg of 15-5-10 fertilizer/ha/yr. Caro-Costas et al. (2) found that yields of Star grass harvested by cutting increased with length of harvest interval up to 60 days. Rodríguez and Silva (5) found that a better stand of Star grass was maintained with high (15–20 cm) than with low (2.5–7.5 cm) grazing. They also found that with low grazing the stand of Star grass increased with length of grazing interval, but with high grazing, grazing interval had little effect on stand.

The present study determined the effect of three grazing intervals on

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the productivity of a well-managed Star grass pasture in terms of weight gains and carrying capacity.

MATERIALS AND METHODS

The experiment was carried out over a 3-year period at the Corozal Substation of the Agricultural Experiment Station located at an elevation of about 200 m. Mean annual temperature is about 25° C and mean monthly variations are about 5° C. Annual rainfall is about 1,600 mm fairly well distributed throughout the year. The soil is a deep, red, Corozal clay (Aquic Tropudults) on a 25% slope.

Twelve 0.4-ha plots of Star grass were used in the experiment. All pastures were provided with water and salt, the soil was limed to pH 6.0, and 560 kg of 15-5-10 fertilizer were applied/ha every 3 months.

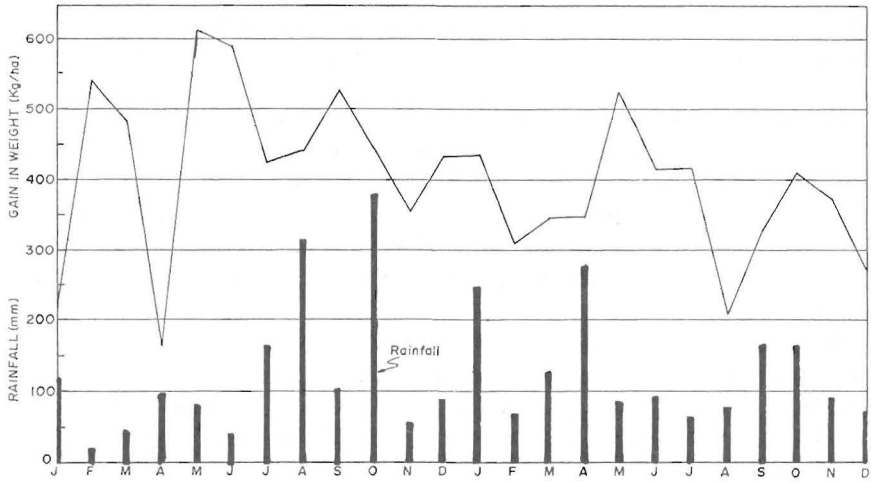

FIG. 1.—Average monthly weight gain made by young Holstein heifers grazing well managed and fertilized Star grass pastures over a 2-year period at Corozal.

Treatments consisted of grazing the pastures at 14-, 21- and 28-day intervals. The forage in each pasture was grazed down to a height of about 20 cm during each grazing round. A complete randomized block design was used with all treatments replicated four times.

The pastures were grazed by young Holstein heifers which were treated periodically for parasites and received no feed other than that obtained from the pastures. The heifers initially weighed about 160 kg and were replaced yearly. A different group of heifers grazed the astures assigned to each grazing interval. Five "tester" heifers were kept per hectare throughout the year on all treatments. Additional heifers were added as required to consume excess forage using the "put and take" system.

These heifers were used very little, and since there was little difference in productivity of the pastures, the heifers were used in equal numbers and over similar periods of time in all treatments.

At the end of each year of grazing, the pastures were rested for about 1 month while a new group of heifers were prepared for use in the experiment. The first round of grazing following this period was used to accustom the heifers to the management regime and conditions of the experimental area. The data obtained were not used in determining the productivity of the pastures. The heifers were not bred during the experiment.

The heifers were weighed each time they were moved from one pasture to another. A record was kept of the grazing days and weight gains for each animal and each pasture. The total digestible nutrients (TDN) produced by each pasture and its carrying capacity were calculated from these data, following recommendations of the Pasture Research Committee (1). Carrying capacities were expressed in terms of 273-kg steers/ha.

During the second year, half of eight 1 × 2 m areas in each pasture was cut to ground level before each grazing. The other half was cut after each grazing. In both cases the harvested forage was weighed and dried. From these data the amount of dry forage actually consumed by the grazing cattle was determined by difference. The sample areas were varied during each grazing cycle so that the data would reflect the effects of trampling and grazing.

Also during the second year, 10 forage samples from each plot were taken before each grazing by plucking in such a way as to simulate grazing. These samples, which were considered to be typical of the forage ingested by the grazing cattle, were analyzed for crude protein, Ca, P, and lignin.

RESULTS AND DISCUSSIONS

Annual rainfall at the experimental site during the course of the experiment ranged from 1,438 to 1,629 mm averaging 1,521 mm yearly/ (table 1). Monthly rainfall ranged from 21 to 378 mm.

Grazing intervals varying from 14 to 28 days did not significantly affect weight gains, average daily gain/head, carrying capacity, and TDN produced by the Star grass (table 2).

On the average, these well fertilized Star grass plots carried the equivalent of 5.28 273-kg steers/ha throughout the year, and produced 7,699 kg of TDN/ha/yr and 1,197 kg of weight gain/ha/yr. The heifers gained an average of 0.52 kg/day.

Yields of dry forage consumed by the grazing cattle, averaging 12,950 kg/ha/yr during the second year (table 3), were not significantly affected by grazing intervals.

Apparent digestibility of the forage, likewise not affected by grazing interval, averaged 62.7% for all treatments during the second year (table 3).

Average annual weight gains for all grazing intervals varied from 1,144 kg/ha/yr in 1975–76 to 1,323 in 1976–77 (table 4). There were no significant differences between treatments during any year.

TABLE 1.—*Monthly rainfall (mm) at Corozal during the 3 years of experimentation*

Month	First year	Second year	Third year	Average
January	144	97	122	121
February	21	119	22	54
March	141	130	49	107
April	56	145	98	100
May	53	78	80	70
June	24	35	42	34
July	74	35	165	91
August	178	96	315	196
September	183	235	103	174
October	201	378	98	226
November	274	56	295	208
December	280	90	49	140
Total	1,629	1,494	1,438	1,521

TABLE 2.—*Effect of three grazing intervals on weight gain and carrying capacity of a well fertilized Star grass pasture over a 3-year period at Corozal*

Grazing interval	Weight gains	Total digestible[1] nutrients	Carrying capacity[2]	Average daily gain per head[3]
Days	*Kg/ha/yr*	*Kg/ha/yr*	*273-kg steers/ha*	*Kg*
14	1,242	7,538	5.16	.52
21	1,239	8,056	5.52	.54
28	1,110	7,503	5.14	.51
	N.S.[4]	N.S.	N.S.	N.S.

[1] Calculated from body weights, days of grazing and weight gain following recommendations of the Pasture Research Committee (1).

[2] One 273-kg steer requires 3.86 kg of TDN daily for maintenance and weight gain of 0.5 kg.

[3] For tester cattle which remained on the pastures throughout the year.

[4] Nonsignificant difference at the 5% probability level.

Grazing interval did not affect protein content of the forage consumed by the grazing cattle, which averaged 17.0, 16.9, and 16.7% with the 14-, 21- and 28-day grazing intervals, respectively (table 5). Protein content varied considerably from month to month ranging from 13.4 to 21%. Protein content of the forage throughout the year was well above the requirements for young growing heifers. No significant relationship was

TABLE 3.—*Effect of three grazing intervals on productivity of a well fertilized Star grass pasture over the second year of experimentation*

Grazing interval	Weight gain		Total Digestible nutrients[1]	Dry forage consumed by grazing cattle	Apparent digestibility of ingested forage[2]
Days	*Kg/ha/yr*		*Kg/ha/yr*	*Kg/ha/yr*	%
14	1,384		8,250	12,440	66.3
21	1,343		8,210	13,030	62.9
28	1,247		7,850	13,380	59.0
	N.S.[3]	N.S.	N.S.	N.S.	N.S.

[1] One 273-kg steer requires 3.86 kg of TDN daily.

[2] $\frac{\text{Forage consumed}}{\text{TDN}} \times 100$

[3] Nonsignificant difference at the 5% probability level.

TABLE 4.—*Annual average weight gain (kg/ha) for each grazing interval*

Grazing interval	1975–76	1976–77	1977–78	Average
Days				
14	1,166	1,384	1,177	1,242
21	1,166	1,343	1,207	1,239
28	1,098	1,247	986	1,110
Average	1,144	1,323	1,123	1,197
	N.S.[1]	N.S.	N.S.	N.S.

[1] Nonsignificant difference at the 5% probability level.

TABLE 5.—*Protein content (%) of Star grass forage obtained over a 1-year period by plucking to simulate grazing, as affected by season of the year and grazing interval*

Month	Grazing interval (days)		
	14	21	28
January	17.9	16.6	17.0
February	20.4	21.0	20.1
March	14.9	14.5	15.9
April	18.2	18.8	19.5
May	18.6	17.9	16.5
June	15.3	14.5	14.9
July	17.9	17.1	16.0
August	17.0	18.5	17.6
September	15.7	16.9	15.9
October	14.0	13.9	13.4
November	17.6	16.8	16.0
December	16.6	16.9	17.2
Average	17.0	16.9	16.7

found to exist between percent protein content of the forage and monthly gains.

Although protein and calcium content of the forage were not affected by grazing interval, phosphorus content was significantly higher when the pastures were grazed every 14 days (table 6).

TABLE 6.—*Average composition of Star grass forage obtained by plucking to simulate grazing over a 1-year period, as affected by three grazing intervals*

Grazing interval	Composition (%)		
	Crude protein	Calcium	Phosphorus
Days			
14	17.0	0.50	0.28[a][1]
21	16.9	0.46	0.16[b]
28	16.7	0.45	0.18[b]
	N.S.[2]	N.S.	

[1] Values followed by the same letter do not differ significantly at the 5% level (Duncan's new multiple range test).

[2] Difference nonsignificant at the 5% probability level.

Average monthly weight gains varied considerably throughout the year but were apparently not related to rainfall (fig. 1).

These data show that Star grass pastures can be grazed at intervals varying from 14 to 28 days without affecting their productivity provided that they are grazed no closer than about 20 cm from the ground and that they are well fertilized. Grazing no closer than 20 cm leaves sufficient photosynthetic area and enough root reserves are maintained to ensure rapid regrowth of the grass after grazing.

If repeatedly grazed close to the ground at short intervals the stand of Star grass will deteriorate and weeds will invade the pastures as shown by Rodríguez and Silva (5).

RESUMEN

Se determinó el efecto de intervalos de pastoreo de 14, 21 y 28 días en la productividad de pastos Estrella en un suelo Corozal durante 3 años consecutivos. Los pastos se abonaron con 550 kg de un análisis 15-5-10/ha cada 3 meses y se pastaron con novillas Holstein a una altura de 20 cm.

Los intervalos entre pastoreos no afectaron el aumento de peso en las novillas ni la producción de nutrimentos digeribles o de forraje. Tampoco afectaron el contenido en proteína bruta del forraje ni su digestibilidad aparente.

En promedio, los pastos produjeron 1,197 kg en aumento de peso/ha y año, 7,699 kg de nutrimentos digeribles/ha y año, y 12,950 kg/ha y año de forraje seco. La capacidad de pastoreo fue equivalente a 5.3 cabezas con un peso medio de 273 kg/ha. El contenido de proteína bruta del forraje fue de 16.8% y la digestibilidad aparente de 62.7%.

Estos datos demuestran que los pastos Estrella bien abonados y pastados a una altura de no menos de 20 cm mantienen una productividad similar cuando se pastan a intervalos de 2, 3 ó 4 semanas brindándole así flexibilidad al ganadero en el uso de los mismos.

LITERATURE CITED

1. Anonymous, 1943. Report on pasture investigations techniques, Joint Comm. Am. Dairy Sci. Assoc., Soc. Agron., and Am. Soc. An. Prod. J. Dairy Sci. 26:353–69.
2. Caro-Costas, R., Abruña, F., and Figarella, J., 1972. Effect of nitrogen rates, harvest intervals and cutting heights on yield and composition of Star grass in Puerto Rico, J. Agri. Univ. P.R. 56 (3):267–79.
.3 ——,——, and Vicente-Chandler, J., 1972. Comparison of heavily fertilized Pangola and Star grass pastures in terms of beef production and carrying capacity in the humid mountain region of Puerto Rico, J. Agri. Univ. P.R. 56 (2):104–19.
4. ——,——, and ——, 1976. Effect of three levels of fertilization on the production of Star grass pastures, J. Agri. Univ. P.R. 60 (2):172–8.
5. Rodríguez, J. A. and Silva, S., 1975. Effect of two heights and three intervals of grazing on stand of a heavily fertilized Star grass pasture, J. Agri. Univ. P.R. 54 (3):214–9.
6. Vicente-Chandler, J., Abruña, F., Caro-Costas, R., Figarella, J., Silva, S., and Pearson, R. W., 1974. Intensive grassland management in the humid tropics of Puerto Rico, Agri. Exp. Stn. Univ. P.R., Bull. 233.