Comparative Productivity of Intensively Managed Star and GuineaGrass Pastures in Terms of Milk Production in the Humid Mountain Region of Puerto Rico[1, 2]

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ABSTRACT

Intensively managed, steep pastures of stargrass outyielded those of guineagrass in terms of milk production when grazed by cows receiving no concentrate feed over a 2-yr period under conditions typical of the humid mountain region of Puerto Rico. Cows on stargrass pastures produced an average of 7,727 liters of milk/ha/yr and provided 729 cow-days of grazing/ha/yr, whereas cows on guineagrass pastures produced 5,593 liters/ha/yr and provided 543 cow-days of grazing. Daily milk production per cow was similar for cows fed on either grass. Cows on stargrass pastures produced more milk during all seasons of the year than those on guineagrass pastures. In addition, guineagrass pastures exhibited more seasonal variations in productivity.

INTRODUCTION

Information is abundant on the best management and fertilizer practices to use with tropical grass pastures in the humid mountain region of Puerto Rico. Caro and Vicente-Chandler (3, 4) found that when fertilization of napiergrass pastures was increased from 675 to 2,025 kg of 14-4-10/ha/yr, weight gains increased from 638 to 1,201 kg/ha/yr, carrying capacity from 3.5 to 5.5 273-kg steers/ha, total digestible nutrients from 4,820 to 7,500 kg/ha/yr and protein content of the forage consumed by the grazing cattle from 8.1 to 15.9%. Caro, Vicente-Chandler and Abruña (5) found that pangolagrass pastures responded to fertilization with 15-5-10 up to 2,688 hg/ha/yr, producing weight gains of 976 kg/ha/hr with a carrying capacity of five 273-kg steers/ha. Caro, Abruña and Vicente-Chandler (2) found that stargrass pastures responded strongly to fertilization up to 3,136 kg of 15-5-10/ha/yr both in beef gains and carrying capacity. From these studies it was concluded that the optimum fertilizer rate for those pastures under conditions typical of the humid mountain region of Puerto Rico was about 2,200 kg of 15-5-10/ha/yr divided into four equal applications every 3 months.

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[3] Agronomist, cooperative between the Science and Education Administration, USDA and the Agriculatural Experiment Station, Mayagüez Campus, University of Puerto Rico, and Location Leader-Soil Scientist, Science and Education Administration, USDA, Río Piedras, P.R., respectively.

Vicente-Chandler, Caro and Figarella (9) found that well fertilized, intensively managed paragrass and molassesgrass pastures produced an average of only 712 kg of gain weight/ha/yr, wheras napiergrass, guineagrass and pangolagrass produced similar gain in weight, averaging 1,181 kg/ha/yr, and carried 6.1 273-kg head/ha. These pastures produced an average of 8,466 kg of total digestible nutrients/ha/yr and the cattle consumed approximately 15,700 kg of dry forage/ha/yr with a crude protein content averaging 18%. Caro, Abruña and Vicente-Chandler (1) found that stargrass receiving 2,240 kg/ha/yr of 15-5-10 produced 1,514 kg of weight gain/ha/yr and carried 7.4 273-kg animals/ha whereas pangolagrass pastures produced 1,062 kg of gain in weight/ha/yr and carried 6.5 head/ha. Crude protein content of the stargrass consumed by the grazing cattle ranged from 15 to 25% throughout the year, and digestibility was about 55%.

Caro and Vicente-Chandler (6) found that nine Holstein cows fed exclusively on well fertilized, intensively managed grass pastures on steep slopes and receiving no concentrate feed, produced an average of 2,044, 3,696, 3,897, 4,058 and 4,817 liters of milk per lactation during five consecutive lactations. These figures show that cows on pastures can produce high yields of milk with no concentrate feed.

Although data is abundant on the productivity of intensively managed tropical grass pastures in terms of beef production and carrying capacity, there is little information on their productivity in terms of milk production.

This paper presents the results of a 2-year experiment during which cows fed exclusively on pastures were used to determine the comparative milk production of cows on steep, well fertilized, intensively managed stargrass and guineagrass pastures under conditions typical of the humid mountain region of Puerto Rico.

MATERIALS AND METHODS

The experiment was carried out in cooperation with a commercial dairy where all cows were fed exclusively on intensively managed tropical grass pastures and received no concentrate feed.

The experimental area is at an elevation of about 600 m. The mean average annual temperature is about 24°C, maximum daily temperature rarely exceeds 31°C and the minimum is seldom less than 18°C. Annual rainfall averages about 160 cm and is fairly well distributed throughout the year.

The herd consisted of Holstein cows of different ages and origins. It included first calf heifers from Wisconsin, first calf heifers from an adjacent farm in Puerto Rico that had been raised on all-grass rations, and older cows. All cows were milked twice daily in a modern milking parlor.

Five pastures of stargrass totalling 24.4 ha, and 5 pastures of guineagrass totalling 25.2 ha, were used in a randomized design. The soil was a deep, red, acid Humatas clay with excellent physical conditions. The average slope was 35%. The soil was limed to about pH 5.5 and fertilized with 2,240 kg of 15-5-10/ha/yr in four equal applications. Fresh water, mineralized salt and bone meal were available in all pastures. The cows were kept on the pastures at all times except during milking.

The milking herd ranged from 140 to 150 cows. Each pasture was grazed for 1 to 2 days and then rested for about 3 weeks before being grazed again.

Records were kept of the milk the cows produced when grazing each pasture and of the cow-days of grazing provided by each enclosure over the 2-yr period.

TABLE 1.—*Monthly rainfall in the experimental area during the 2 years of experimentation*

Month	1974	1975	Average
	mm	*mm*	*mm*
January	154	178	165
February	73	5	39
March	75	126	101
April	126	142	134
May	152	78	115
June	29	19	24
July	73	130	102
August	125	118	122
September	182	392	287
October	618	97	357
November	297	376	236
December	151	268	219
Total	2055	1727	1893

RESULTS AND DISCUSSIONS

Table 1 shows monthly and total rainfall during the 2-yr. experiment. Rainfall totalled 2,056 mm in 1974 and 1,727 mm in 1975. Monthly extremes ranged from 5.1 mm in February 1975 to 618 mm in October 1974.

Table 2 shows that cows on the stargrass pastures outyielded those on guineagrass, producing an average of 7,727 liters of milk/ha/yr as compared with 5,593 liters/ha/yr on guineagrass. Cow-days of grazing averaged 729/ha/yr for stargrass as compared with only 543 for guineagrass. Daily milk production per cow, however, averaged only slightly more for stargrass than for guineagrass: 10.6 and 10.2 liters/cow/day, respectively. It is therefore evident that the higher milk yields produced by the

stargrass pastures resulted from higher forage yields, as reflected in more cow-days on grazing, rather than from better quality forage, which would probably have been reflected in higher daily milk production per cow. This agrees with the findings of Vicente-Chandler et al. (8), which showed little difference in the nutritive value of most tropical grasses if they are managed similarly.

Table 2 also shows that the stargrass pastures produced more total digestible nutrients (5,236 kg/ha/yr) consumed by the grazing cattle than did guineagrass (3,872 kg/ha/yr). These levels of total digestible nutrients are rather low compared with those found by Caro et al. (1, 2) for young

TABLE 2.—*Productivity over a 2-yr period of intensively managed stargrass and guineagrass pastures grazed by cows receiving no concentrate feed*

Pasture	Area (ha)	Milk production	Grazing provided	Average daily milk production per cow	Total digestible nutrients in forage consumed[1]
		(L/ha/yr)	*Cow-days/ha/yr*	*Liters*	*Kg/ha/yr*
			Stargrass		
S-1	5.6	7,567	734	10.3	5,206
S-2	4.0	9,573	923	10.4	6,564
S-3	4.8	11,260	1,008	11.1	7,410
S-4	8.0	4,876	467	10.5	3,331
S-5	2.0	7,422	710	10.4	5,067
Weighted average		7,727[2]	729[2]	10.6	5,236[2]
			Guineagrass		
G-1	3.2	6,780	664	10.1	4,690
G-2	3.2	6,323	625	10.1	4,397
G-3	4.8	3,980	388	10.3	2,746
G-4	6.0	5,725	553	10.4	3,930
G-5	8.0	5,696	549	10.3	3,905
Weighted average		5,593	543	10.2	3,872

[1] Cows weighed an average of 500 kg. They required 4 kg of total digestible nutrients daily plus 0.3 kg per liter of milk produced.

[2] Differences are statistically different at the 1% probability level.

cattle grazing small enclosures. This difference is possibly due to the more efficient use of the forage produced in these authors' grazing experiments, where rather small pastures (0.4 ha) were used, compared to the much larger pastures under commercial farm conditions used in this experiment.

Figure 1 shows that cows on stargrass pastures produced more milk during all seasons of the year than did those on guineagrass and that guineagrass also varied more in production from one season to another than did stargrass.

Cows on stargrass pastures produced an average of 7,727 liters of milk/

ha/yr which had a farm value of about $2,700/ha/yr with inputs for materials (2,300 kgs of 15-5-10 fertilizer + 3 MT of lime/ha/yr) of $410. Fairly well-managed dairies in Puerto Rico use 600 kg of fertilizer/ha/yr, which costs $115. To produce the same amount of milk as the cows on stargrass pastures did, they feed 3,510 kg of concentrates costing $773/ha/yr for a total cost of $888 in materials. Thus, by producing milk with

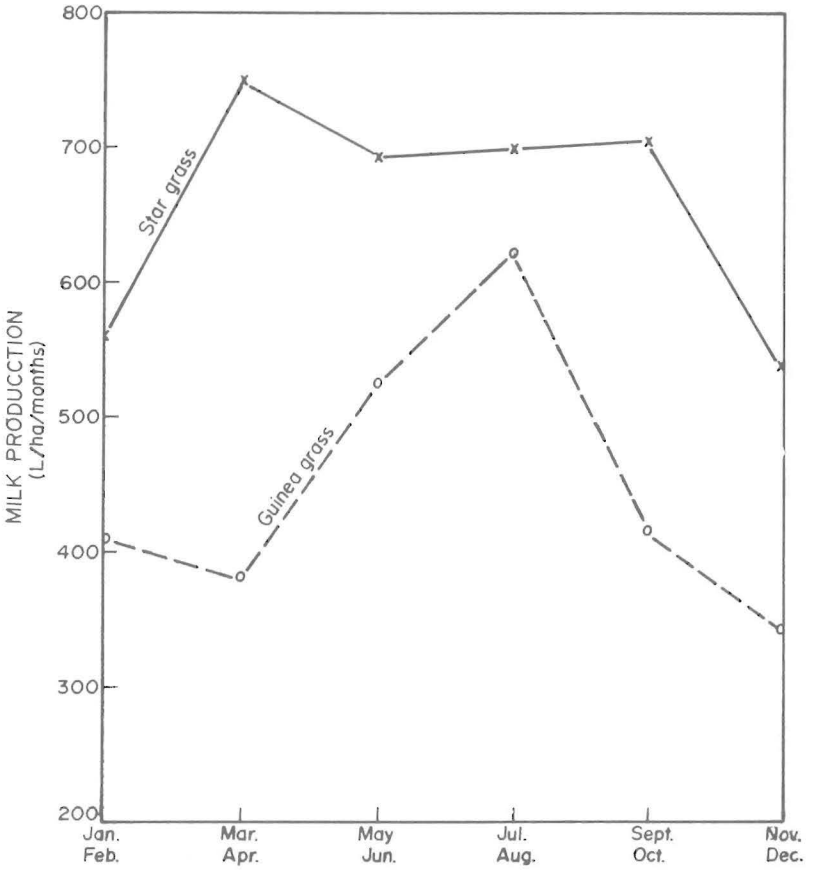

FIG. 1.—A two-year record of average monthly milk production of cows grazing steep intensively managed star and guinea grass pastures without receiving concentrate feed.

cows fed on intensively managed pastures, which are largely the product of the Island's natural resources of climate, soil and water and not feeding concentrates the cost of imported materials could be reduced by more than half from 11.5 to 4.94¢ per liter of milk.

There are about 150,000 ha of deep, moderately steep soils suited to intensively managed grass pastures for milk production in the humid

mountain region of Puerto Rico. These lands have few alternative uses; they are not suited to mechanized crop production; and they require the protection against erosion that well managed pastures provide.

Serra, Vicente-Chandler and Llorens (7) have shown that net farm income can be increased just as much by using higher producing cows and feeding more concentrates as by acquiring more cows of similar production and putting more land into pastures. The second alternative is more desirable for the Island's economy. Imports can be reduced sharply and good use made of thousands of hectares in the humid mountain region with a good potential for milk production and few alternative uses.

RESUMEN

Durante 2 años se determinó la productividad bajo condiciones típicas de la región montañosa de Puerto Rico de los pastos estrella y guinea cultivados intensivamente y pastados por vacas lecheras que no recibían alimento concentrado alguno.

Con el pasto estrella fue posible producir un promedio de 7,727 litros de leche/ha y año con 729 días-vaca de pastoreo/ha y año comparado con un promedio de 5,593 litros de leche/ha y año y 543 días-vaca de pastoreo con el guinea. La producción de leche/vaca y día fue similar en ambos casos. Con el pasto estrella se produjo más leche durante todas las épocas del año que con el guinea, con el cual la producción, además, varió más según la época del año.

Las vacas en los pastos estrella produjeron leche con un valor de alrededor de $2,700/ha y año con insumos importados ascendentes a sólo 4.94 centavos/litro de leche. En Puerto Rico, en vaquerías bien administradas el costo de los insumos importados ascienden a alrededor de 11.5 centavos/litro de leche. Produciendo la leche mayormente en pastos, se puede hacer un mejor uso de los recursos de clima, suelo y agua de la región montañosa húmeda, donde hay más de 150,000 hectáreas aptas para la producción de pastos para ganado lechero y que ofrecen pocos usos alternos.

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