ABSTRACT

COST OF PRODUCING GRASS UNDER COMMERCIAL CONDITIONS IN JAMAICA

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It has long been established that pastures provide the most economical source of feed for milk production. With the rising cost of imported concentrates the Jamaican dairy farmer, if he is to become competitive, must make better utilization of available resources. One such resource is pasture. Though the complete removal of concentrate feed from the diet is not being advocated, greater utilization of pasture presents the most convenient strategy for increased competitiveness for Jamaican dairy farmers.

A two-year study was therefore carried out to determine the cost of producing pasture at Serge Island Farms in St. Thomas, Jamaica, commencing April 2001. Other objectives of the study were to determine dry matter yield, average dry matter consumption per cow and nutritive value throughout the year. Two grasses were studied namely: Tifton Bermuda grass (*Cynodon spp*) and African Star (*Cynodon nlemfuensis*).

Pastures were fertilized at an average rate of 447.5kg N per hectare per annum. Grazing cycles were 18-21 days and stocking rate, 5.4 cows per hectare. Irrigation was applied for 86 days in 2001 and 35 days in 2002.

Mean dry matter yields of 26.1t and 20.76t per hectare per annum were recorded for Tifton and African Star respectively.

Mean daily dry matter intakes over the two years were 5.8kg and 3.8kg DM per cow, a superiority of 53 percent to the Tifton.

Cost per tonne of herbage dry matter averaged J$402 and J$528 for Tifton and African Star respectively, a 24 percent cost advantage to the Tifton.

The results suggest that Jamaican farmers are capable of producing grass at approximately $1/30^{th}$ the current cost of concentrate feed and stresses the need to maximally exploit the proven potential of tropical pasture for producing milk in the pursuit of international competitiveness.

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INTRODUCTION

Jamaican dairy farmers have been slow in adopting the technologies available for optimally exploiting pastures for economic production, despite the body of data which has become available over the past two or more decades. A review of studies carried out during the decade ending 1980 indicated that unsupplemented yields on tropical pastures ranged between 1850-4070 litres milk per cow per year (Jennings and Holmes, 1985). Where supplementary feed was offered, yields of the order of 27,250 litres per hectare per year have been recorded at stocking rates of 5 cows per hectare (Yazman et al 1982).

These studies confirm the tremendous potential of the tropical pasture system for sustained economic milk production which if applied could confer significant competitive advantage to Jamaican dairy farmers.

The basis for this competitive advantage resides in the higher growth potential and the greater potential response to fertilizer nitrogen by improved tropical, in comparison to temperate grasses. This was established by the early work in Puerto Rico (Vicente Chandler et al 1964) which reported yields above 30 tonnes per hectare per year at commercially acceptable defoliation intervals from a range of grasses with response to fertilizer Nitrogen averaging approximately 40 kg dry matter per kg fertilizer N up to levels of 400 kg N/ha/yr under high rainfall conditions. This potential has been confirmed in subsequent studies from other tropical centers including Jamaica. A later study by Jennings (1992a) indicated yields from African Star grass as high as 45 m.t. per hectare per year, with response to fertilizer N calculated at 60 kg DM per kg N up to 300 kg N per ha per year.

Contrastingly maximum herbage yields on temperate pastures have been reported at 15-16.5 m.t. DM/ha/yr (Morrison, 1980) which limit potential milk production to below 16,000 litres/ha. Countries such as New Zealand and Australia, however, have been able to successfully convert this limited potential to competitive advantage and are currently the least cost producers of milk internationally.

The Jamaican dairy industry is challenged to significantly reduce production costs if it is to claim a larger share of the very lucrative dairy products market. A strategy which might most effectively contribute to cost reduction would be one which seeks to optimally exploit the productivity of the pasture system in combination with judicious use of concentrate feeds to maximize individual animal production. Knowledge of the cost of producing grass is a prerequisite to this strategy.

It was therefore on this basis that a two-year study was undertaken, to determine, under commercial conditions, the cost of producing grass on well-managed pasture. The study was undertaken, at Serge Island Farms, Seaforth, St. Thomas, between April 2001 and March 2003 and included two improved tropical grasses, African Star grass (*Cynodon Nlemfuensis*) and the recently introduced hybrid Tifton Bermuda grass (*Cynodon Spp*).

Other objectives of the study were the determination of comparative annual yields and nutritive value of both grasses.

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METHODOLOGY

The study constituted a comparative analysis of some pasture grass yields, and was conducted over a period of two years. It was carried out at Serge Island Farms in St. Thomas, Jamaica. Two pastures each of 0.8 hectares (2 acres) were selected, one established in Tifton 85 Bermuda grass and the other in African Star grass (*Cynodon nlemfuensis*). Pastures were fertilized at the rate of 526.25 kg N per hectare over 11 applications in year 1 and 368.75 kg N per hectare in 9 applications for year 2. Pasture were stocked at 5.4 cows per hectare with Jamaica Hope Cows and were grazed on a 21 – day rotation The pastures were irrigated for 86 days in year 1 and 35 days in year 2.

Grass samples were taken immediately before and after each grazing. Ten (10) samples were cut to ground level each time across each of the two pastures using a 2x0.25m quadrat. Yield was determined from the herbage mass derive. Sample weights were taken fresh and again after being oven-dried at 100 degree C. for 24 hours to determine dry matter (DM) content. The consumption of dry matter was determined from the difference between pre- and post –grazing herbage mass. The areas sampled for dry matter consumption were randomly selected during each grazing cycle to minimize errors due to trampling and grazing effects.

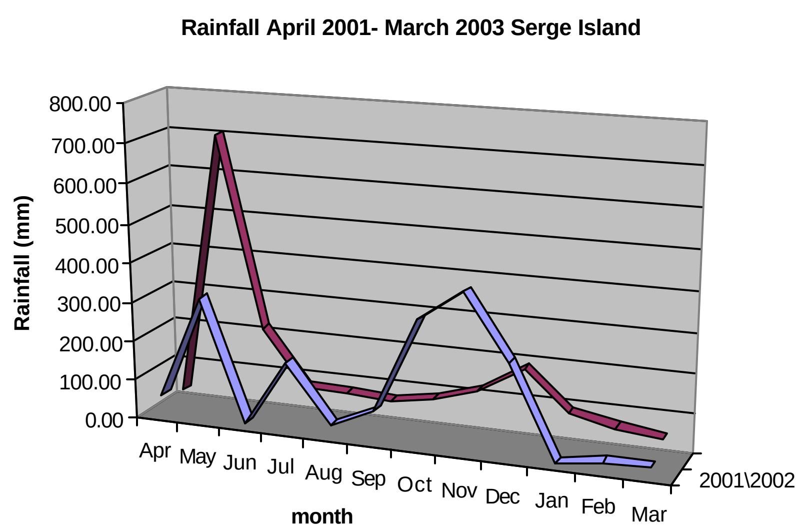
Before each grazing, two forage samples were taken randomly throughout each pasture by plucking to simulate grazing. The assumption was that these samples were typical of the forage consumed by the grazing cattle. The samples were analyzed for crude protein and neutral detergent fiber (NDF). In-vitro organic matter digestibility (IVOMD) was also determined by using the Van Soest method. This would provide a year profile of the quality and nutritive value of both grasses.

RESULTS AND DISCUSSION

Rainfall measurements were taken daily at Serge Island Farms. Readings for years one and two were 1684 mm and 1813 mm respectively with an average of 1748.5 mm. Monthly rainfall ranged from 5 to 705 mm (Fig. 1).

Pastures were irrigated in periods of low rainfall. Irrigation was applied for 86 days in year 1 and 35 days in year 2.

Fig.1. Rainfall pattern at Serge Island during the two-year period of study



	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
2001\2002	57.10	318.90	7.80	176.10	33.20	79.20	321.10	400.00	238.10	5.00	22.50	25.00
2002\2003	34.80	705.50	220.60	81.30	80.00	70.00	89.00	123.70	189.70	93.40	69.30	55.80

Table 1 shows the number of days on which irrigation was applied at Serge Island farm throughout the period of study (April 2001-March 2003).

Table 1. Irrigation pattern during 2-year period of study

	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
2001/2	4	4	4	10		11			10		13	27
2002/3	15	12		5	3							

Yearly Net Herbage Accumulation (NHA) (kg DM/ha.) averaged 27,880 in year 1 and 24,329 (yr. 2) for the Tifton, while the corresponding values for African Star were 19,328 and 21,360 (Table 2).
A high frequency of negative NHA's was recorded in year 2 indicating unscheduled grazing of pastures prior to sampling dates. This was more so for the African Star grass pastures. These were treated as missing values in analyzing the data.
Mean herbage dry matter yields over the 2 years of this study were 26,105 and 20,344 kg/ha for Tifton and African Star respectively, a superiority of 28.3% to Tifton.
Mean apparent DMI per cow per day over the 2 years were 5.89 and 3.84 kg for the Tifton and African Star respectively (Table 3).
An observation of some value was that when cows grazing African Star after the Tifton, there was an apparent marked reduction in intake, indicating a higher level of acceptability of the latter. The spatial arrangement of these pastures might be critical to maximizing the utilization of African Star.

Table 2. DM yield as NHA (in kg/ha/year) for Tifton and African Star grass pastures during the 2 years of study

Pasture	Year 1	Year 2	Average
Tifton	27880	24329	26105
African Star	19328	21360	20344

Table 3. Kg apparent dry matter intake (DMI) per cow per day over a 2-year period of observation

Pasture	Year 1	Year 2	Average
Tifton	6.48	5.19	5.89
African Star	4.46	3.08	3.84

The percentage herbage utilization over the two years averaged 33 and 16 percentage respectively for the Tifton and African Star.
The total cost of producing pasture was based on actual figures taken from the Serge Island Farms accounts (Table 4). Total cost per hectare includes fertilizing, pasture maintenance, and all the various expenses related to pasture such as fuel and tractor costs, irrigation labour, etc. This cost averaged J$12,976 and J$8,237 per hectare for years 1 and 2 respectively. The cost per tonne of dry matter over the two years averaged J$402 and J$528 for Tifton and African Star grass respectively, a 24 percent cost advantage to the Tifton.

Table 4. Cost of pasture production at Serge Island Farms

	2001/2002		2002/2003		Mean	
Item	Tifton	African Star	Tifton	African Star	Tifton	African Star
DM Yield (t/ha)	27.88	19.33	24.33	21.36	26.11	20.35
Kg N/ha	526.25		368.75		447.5	
Fertilizer cost (J$/t)	13,714		15,965			
Cost/kg N (J$)	29.81		34.71			
Total pasture cost/ha (J$)	12,976		8,237			
Cost/t pasture DM (J$)	465	671	339	386	402	528

The overall application of nitrogen fertilizer averaging 447.5 kg N per hectare per annum for the two years supported a stocking rate of 5.4 cows. Overall yield of 23 tonnes DM/ha at this level of nitrogen closely parallels those calculated by Jennings (1992b) from the results of earlier work on tropical pastures. Levels beyond 450 kg N per hectare per annum, however, have been shown to result in diminishing returns (Vicente-Chandler *et al.*, 1964).
Table 5 summarizes the annual mean values for Crude Protein contents and IVOMD for both grasses. The overall means (CP – 13.4 v 14.0; IVOMID – 58.0 v 58.3) for Tifton and Star grass respectively were similar for both grasses but lower than corresponding values reported for Tifton from the USA (Hill et al 1995) and African Star grass from Puerto Rico (Caro-Costas *et al*, 1976)

Table 5 mean annual crude protein content and IVOMD

	2001/02		**2002/03**	
	Tifton	**African Star**	**Tifton**	**African Star**
Crude Protein (%)	13.3	14.5	13.6	13.5
IVOMD (%)	58.4	57.1	57.6	59.6

The monthly variation in pasture quality is shown in Figures 2-5. Except for the apparently anomalous low values for crude protein on Tifton recorded between November and January of year 2, there did not appear to be any consistent seasonal pattern in the nutritive value of both grasses as measured. This might have been reflective of the regularity in the application of nitrogenous fertilizer at Serge Island.

Fig. 2 Monthly variation in pasture quality (CP%) 2001-2002

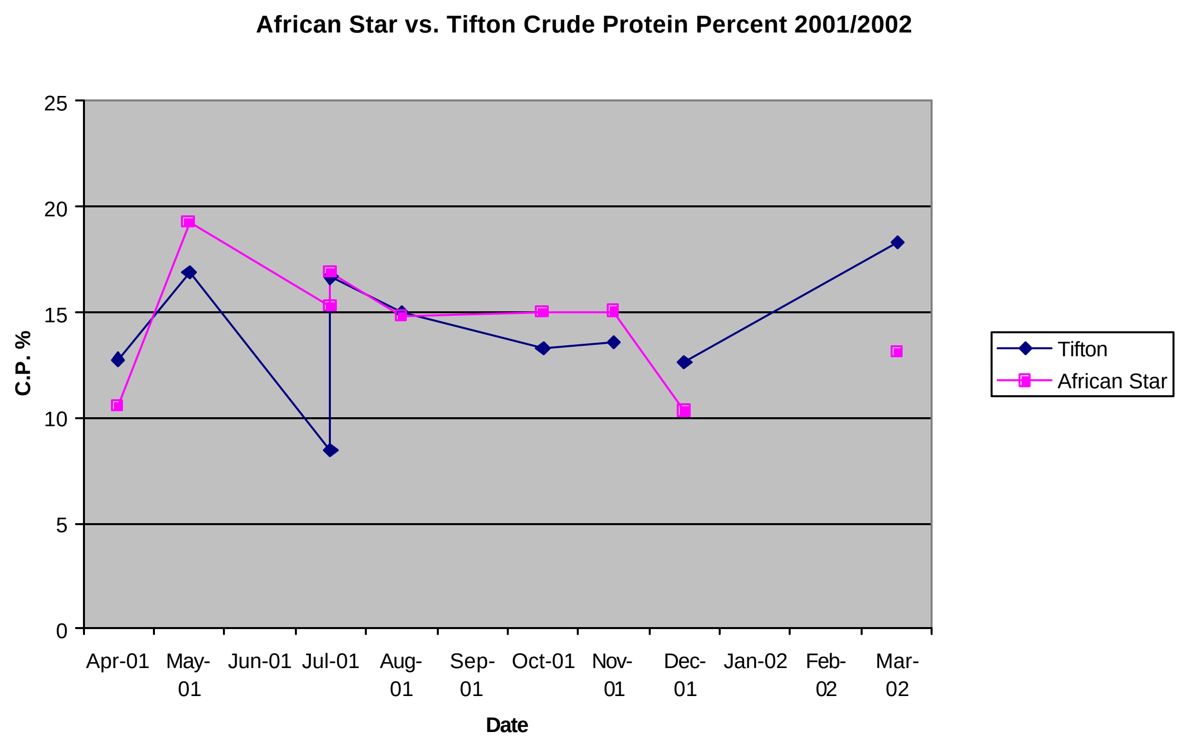


Fig. 3 Monthly variation in pasture quality (CP%) 2002-2003

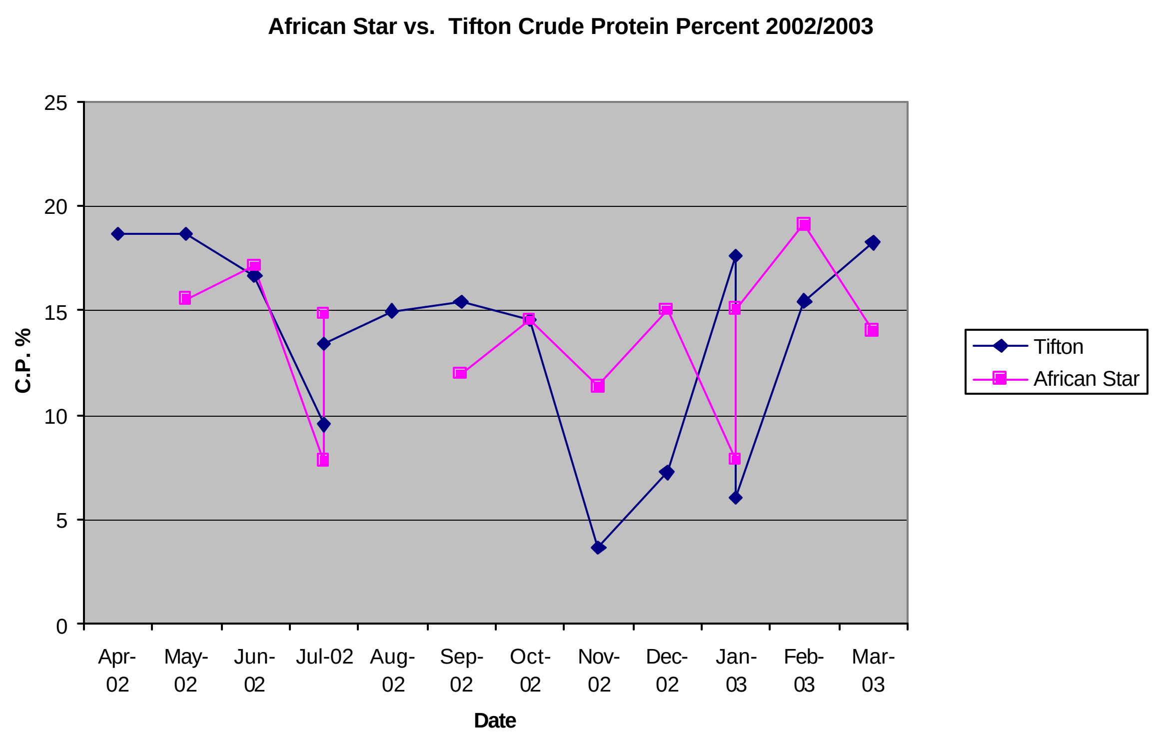


Fig. 4 Monthly variation in pasture quality (IVOMD) 2001-2002

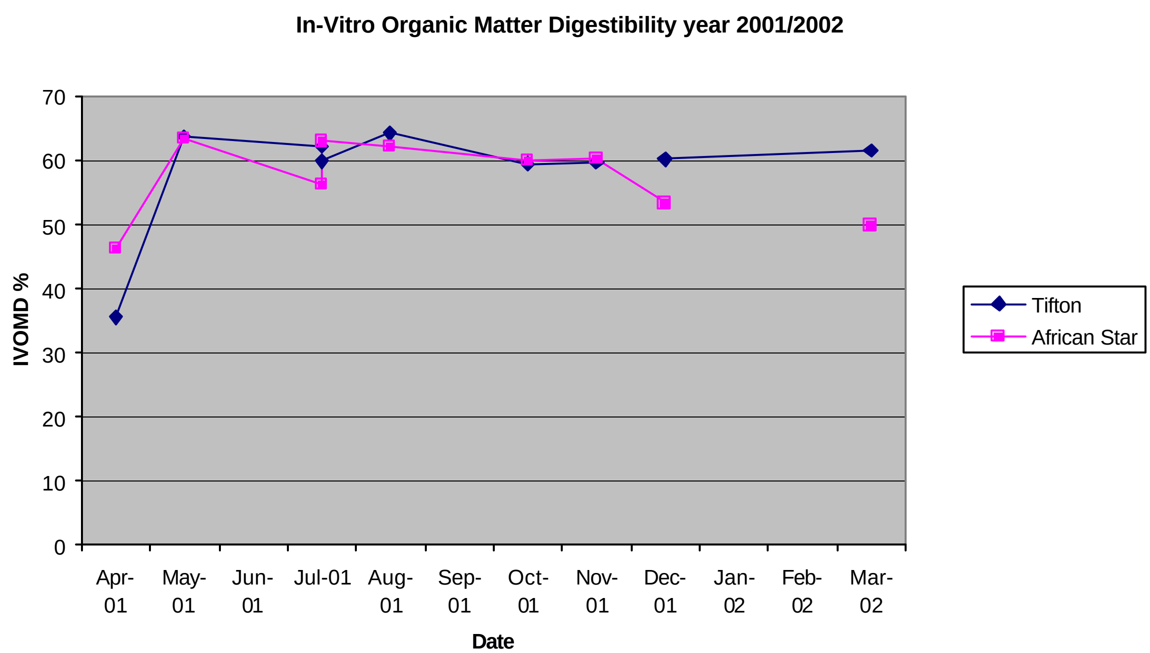
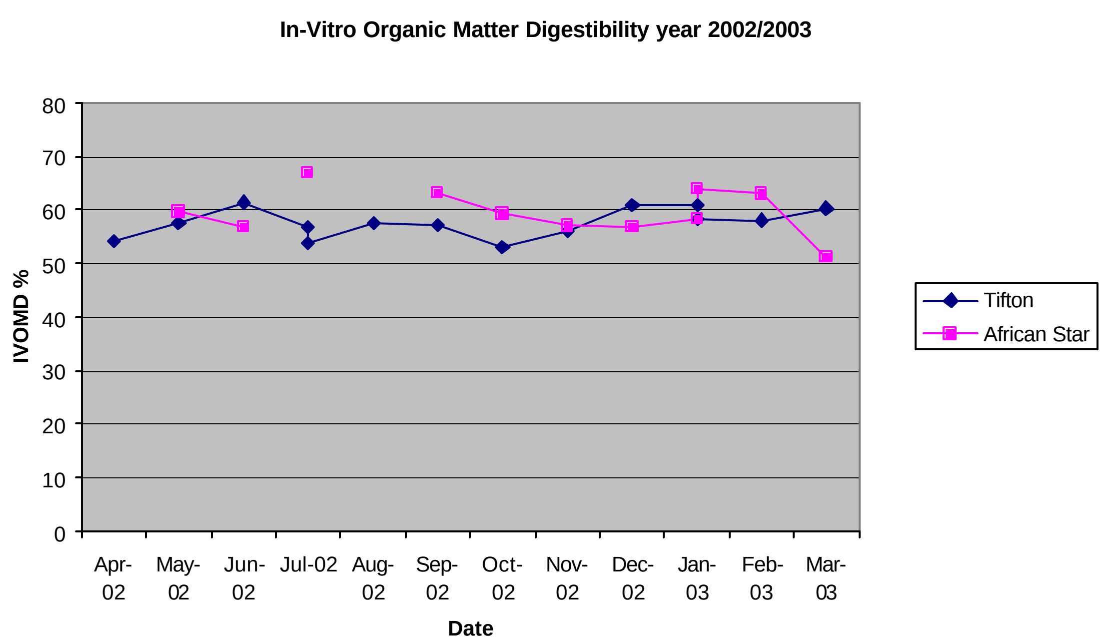


Fig. 5 Monthly variation in pasture quality (IVOMD) 2002-2003



IMPLICATIONS OF THE STUDY FOR ECONOMIC MILK PRODUCTION

The results indicated a 28 percent advantage in dry matter yield to Tifton over the more popular African Star grass; a superiority which converts to an extra cow per hectare per year in carrying capacity at the levels of nitrogen applied in this study 447 kg N/ha./year. At a typical yield of 2800 litres per cow per year this translates to incremental annual revenue of $56,000 per hectare.
The differences in cost of producing grass calculated in this study, definitely favours more widespread use of the Tifton Bermuda hybrid where geographical and soil conditions favour this grass.
Cost of producing grass in this study, overall, was $465.00 per tonne of dry mater and compares with concentrate feed costs of $13,500 on an equivalent dry matter basis. These cost disparities confirm earlier recommendations that at levels of milk production below 3500 litres per cow, the feeding of concentrates above 40 percent of daily dry matter intake is neither nutritionally nor economically justifiable (Jennings 1992a).
Given the site - specific nature of grass growth and response to fertilizer inputs it is intended to replicate this study over time under varying geographical location.

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