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Potential Economic Impact of a BAGAMES Plant on Milk Production

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ABSTRACT

The potential economic impact of a BAGAMES plant on milk production was estimated. A volume of 100 t/d of dried product was used. The cows in the study had the following features: 420 kg live weight, no weight gain, undergoing the third lactation period, a capacity of 17.0 l/cow of potential milk, with 3.8 % of fat. Production was estimated at 10.0 l/cow. CALRAC software was used. Two cases were evaluated: dry season (210 days), where the animal has high energy loss caused by motion; and the rainy season (155 days), with less motion. In both cases the animals ate BAGAMES and low quality grass (pitilla and Texan), with A-2 salt. The introduction of the technological proposal had a significant economic impact, with import savings accounting for more than 4 600 t of powdered milk a year, and $ CUP 12 243 614.45 to the balance of payments.

Key Words: *animal nutrition, protein improvement, solid-state fermentation, milk*

INTRODUCTION

Sugar industry residues in Cuba have been commonly used naturally or processed for animal nutrition. Varied research has led to protein-improved products by FES (Solid-State Fermentation), like saccharine (Elías *et al.*, 1990) and *Bagarip* (Pedraza *et al.*, 2000). However, the technologies used for production have obstructed commercial production (Ramos, 2000). As a result, the raw material costs on imports to produce feedstuffs for cattle nutrition are still high (Guevara *et al*., 2007).

In search for solutions based on FES to obstacles for animal feed production, a BAGAMES plant was designed (Ramos, 2000) to use improved sugar cane bagasse for animal nutrition.

The application of this technology must have a positive impact on animal production (meat, eggs and milk yield increases). Milk production was chosen in the study to make estimations of its economic impact as an essential nutritional source for people, and because of the current high sale prices. The purpose of this paper is to estimate the potential economic impact of a BAGAMES plant on milk production.

MATERIALS AND METHODS

Fig. 1 shows a box graph that represents the different stages of the process. On the first stage, the raw materials are mixed, and the fresh yeast (in situ produced by submerged fermentation) is added. The mixture feeds the fixed-bed bioreactor, where the culture medium stays inside during the residence time, with a continuous flow of air from the bottom through the top, supplied from the humidifier column that provides the required moisture for the process. Then, the humid product goes through the hot-air drier, and the product is ground, pressed and packed.

To estimate the impact of this technology, a volume of 100 t/d of dried product was used, similar to the volume used at the saccharine plant built in the 1980s, at the *Siboney* Sugar Company.

CALRAC software (Institute for Animal Science, 1996), designed for ruminant nutrition studies, was used to calculate the potential economic impact of the BAGAMES plant on milk production. The study was performed for cow nutrition, with the following features: 420 kg live weight, no weight gain, cows undergoing their third lactation period, a potential capacity of 17,0 l/cow, with 3.8 % fat. Milk production was estimated at 10.0 l/cow.

Two cases were evaluated: the dry season (210 days), with higher animal weight loss due to motion; and the rainy season (155 days), with lower motion-related losses. In the two cases, the animals fed on BAGAMES, low quality grass (pitilla and Texan) and A-2 salt. Table 1 shows the features for each feedstuff in the ration, in either case.

RESULTS AND DISCUSSION

Fig. 2 and 3 show the feedstuff volumes each animal must receive in each case. In the first col-

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umn of the results section, the BAGAMES usability factor was included (90%). The results indicate that to achieve the 10 l/cow production in the dry season, 6.5 kg/cow must be supplied. In the rainy season, only 4.0 kg/cow are necessary for the same production.

Daily BAGAMES consumption per cow, depending on the season, was used to calculate the total number of cows that can feed in the rainy and dry seasons, to achieve the desired milk yields. Then, the milk increase was calculated per cow, using the average milk production data reported by García (2007), with 3 000 females from different areas of the western, central and eastern parts of the country. A comparison study was made between the equivalent value of that production in powdered milk, and savings from import cuts, considering the current international prices, of $ 5 200 pesos a ton (Castro, 2007). Table 2 shows the savings that can be achieved by substituting 4 696.3 t/year of imported powdered milk, of $ 24 420 522.9 every year.

The effect on the payment balance was calculated as reported by Brizuela (1987), from import savings, the production costs excluding investments costs and other deductions. Income was $ 12 243 614.45 pesos.

CONCLUSIONS

Investment in a plant of that capacity has largely beneficial effects on the country´s economy, evidenced by import cuts, of more than 4 600 tons of powdered milk, with a contribution of $ 12 243 614.45 pesos to the payment balance.

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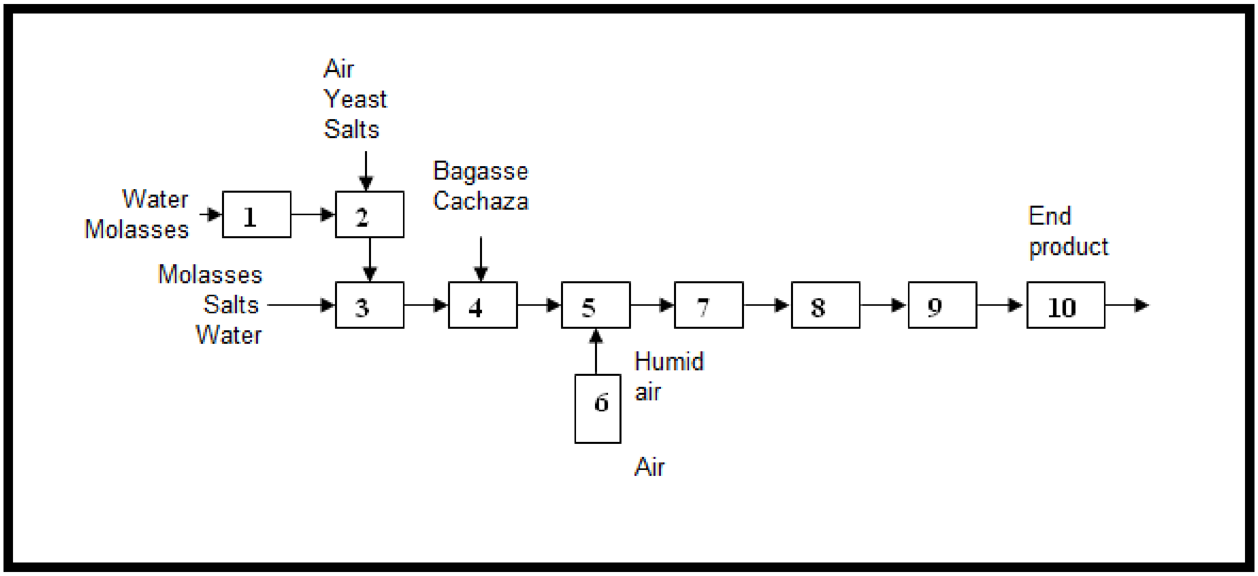
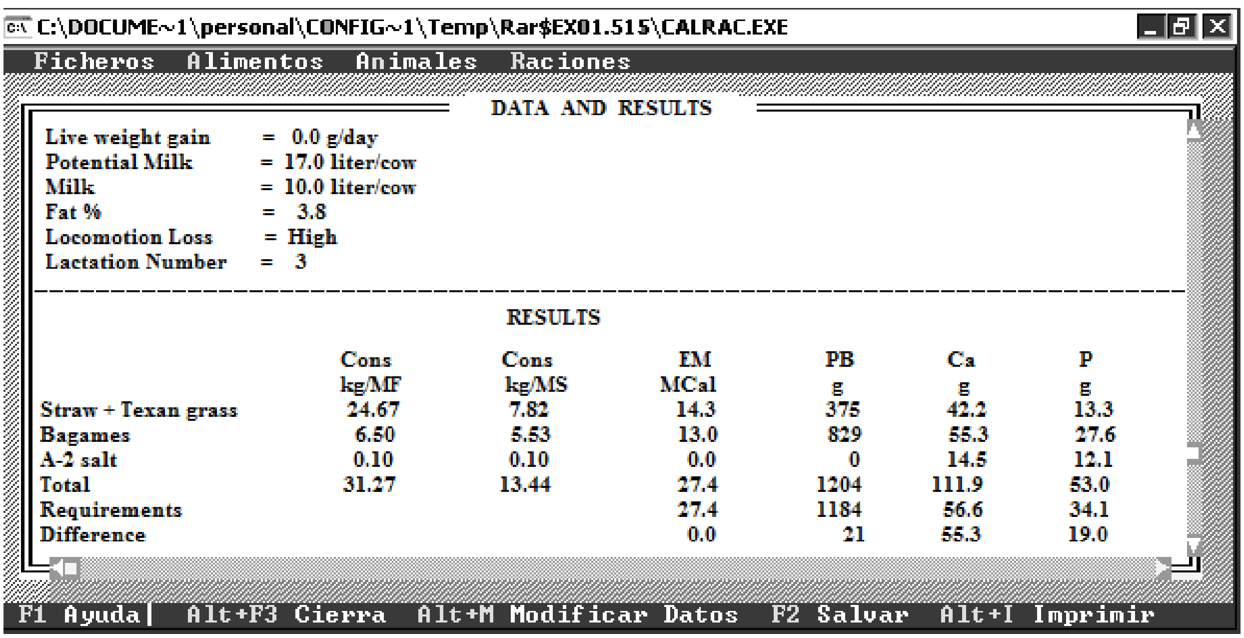


Fig. 1. Box Diagram. 1) Dissolution, 2) Submerged Fermentation, 3) Mixing, 4) Culture media mixing, 5) Solid-state fermentation, 6) Humidifying, 7) Drying, 8) Grinding, 9) Pressing 10) Packaging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DATA AND RESULTS

Live weight gain = 0.0 g/day
Potential Milk = 17.0 liter/cow
Milk = 10.0 liter/cow
Fat % = 3.8
Locomotion Loss = High
Lactation Number = 3

RESULTS

	Cons kg/MF	Cons kg/MS	EM MCal	PB g	Ca g	P g
Straw + Texan grass	24.67	7.82	14.3	375	42.2	13.3
Bagames	6.50	5.53	13.0	829	55.3	27.6
A-2 salt	0.10	0.10	0.0	0	14.5	12.1
Total	31.27	13.44	27.4	1204	111.9	53.0
Requirements			27.4	1184	56.6	34.1
Difference			0.0	21	55.3	19.0

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Fig. 2. Ration for the dry season

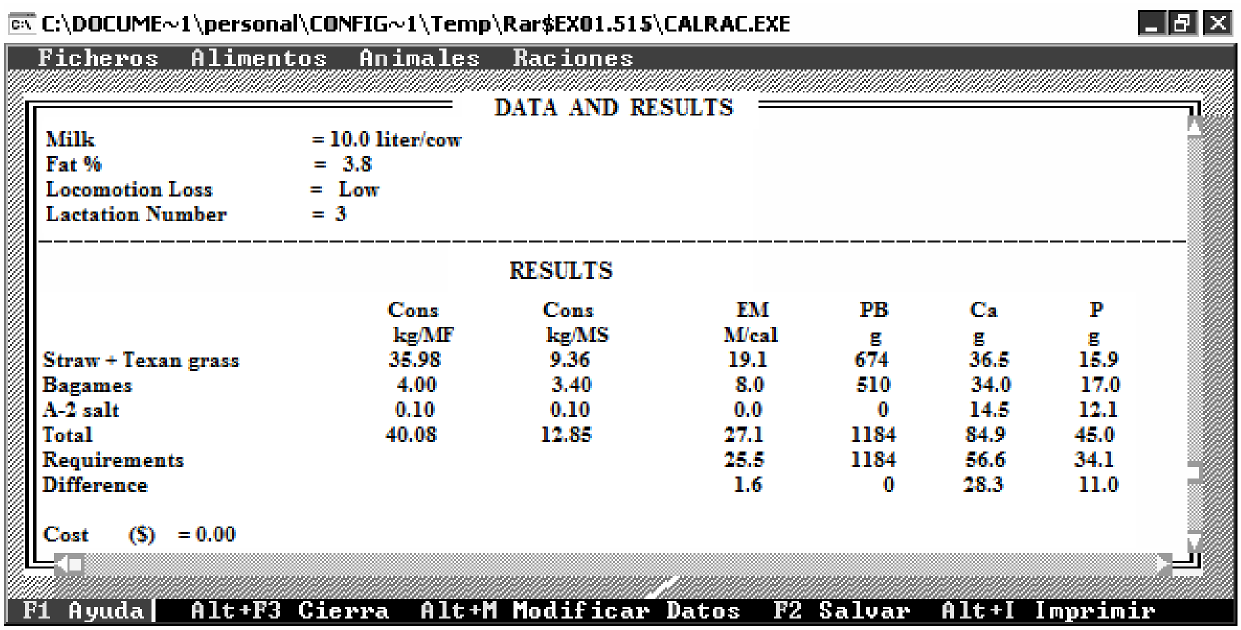

Fig. 3. Ration for the rainy season

Table 1. Characteristics of feedstuffs that make up the ration

Name	BS (%)	PB (g/kg)	Ca (g/kg)	P (g/kg)	EM (Mcal)	PDIN (g/kg)	PDIE (g/kg)	ICO UC	ICB UC
Variant: Dry season									
Grass Straw (Pitilla) + Texan	31.7	48	5.4	1.7	1.83	23.6	36.6	0.8	0.8
BAGAMÉS	85	150	10	5	2.36	84.4	87.8	1	1
Salt A-2	97	0	149	125	0	0	0	1	1
Variant: Rainy season									
Name	BS (%)	PB (g/kg)	Ca (g/kg)	P (g/kg)	EM (Mcal)	PDIN (g/kg)	PDIE (g/kg)	ICO UC	ICB UC
Grass Straw (Pitilla) + Texan	26	72	3.9	1.7	2.04	44.2	61	1	1
BAGAMÉS	85	150	10	5	2.36	84.4	87.8	1	1
Salt A-2	97	0	149	125	0	0	0	1	1

BS: Dry food, Ca: Calcium, EM: Metabolizable energy, ICB: Bovine consumption rate, ICO: Ovine consumption rate, P: Phosphorous, PDIN: Nitrogen digestible protein in the intestine, PDIE: Energy digestible protein in the intestine

Table 2. BAGAMÉS introduction assessment for milk production

Season	BAGA-MÉS (kg/v/d)	Cows Fed	Production without BAGAMÉS (L/v/d)*	Increase (L/c/d)	Increase (L/d)	Equivalent in powdered milk (t/d)**	Milk (t)
Dry 210 days	6.5	15 384	2.9	7.1	109 226.4	10.9	2 293.8
Rainy 155 days	4	25 000	3.8	6.2	155 000.0	15.5	2 402.5
Total milk (t/a): 4 696.3							

* Average milk production per cow according to the season, data reported by García (2007)

** Data supplied by Dairy Union Technical Management