Economic and Productive Characterization of Dairy Units Integrated to the Municipal Cattle Raising Program (PROGRAM) in the Province of Camagüey, Cuba

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ABSTRACT

The economic and productive behaviors of dairy units were characterized between 2009 and 2013, integrated to the Municipal Cattle Raising Program (PROGRAM).Ten dairy farms were chosen in the study, grouped in four agricultural enterprises of Camagüey. The main principle of the experiment was to achieve food self-sufficiency in the farms. The study was divided into three stages: (I) characterization of limitations by a farm diagnostics; (II) proposal and incorporation of technologies; (III) follow up and evaluation of results. The analysis included economic and productive indicators suggested by the Ministry of Agriculture. Forage balances were made, and a pasture-forage arrangement was set up, according to the results provided by the REGPAST software. The methodology established by Toro (2011) was used for characterization in three stages: variable reviewing and selection, Principal Component Analysis, and Conglomerate Analysis. The results showed an increase of economic and productive indicators at the end of the stage, which helped determine system behavior. Moreover, all the indicators selected were included in some components, which explains the 89 % of total variability. Accordingly, three groups of dairy units were set up, corresponding with the development programs for each, with mean values of 1 553.0 kg per hectare for the first group; 874.25 kg, for the second; and 1 361.67 kg, in the third group.

Keywords: *food self-sufficiency, dairy units*

INTRODUCTION

In the early 2000, a new movement toward cattle feed self-sufficiency at farm level was started. It was defined by the Ministry of Agriculture (MINAG) as units that could supply themselves in terms of feed resources, both qualitative and quantitatively, throughout the year. It relied on pasture and forage planting, including new varieties introduced in the country; as well as water supply to the farm (MINAG, 2001).

This process gained strength with the implementation of Municipal Cattle Raising Programs (PROGRAM), led by the Institute for Pasture and Forage Research. It worked under this principle and set out to develop technological alternatives for efficient production strategies in milk production, promoting the use of local resources in the municipality (Álvarez, 2004).

The previous determined a significant variability in terms of economic and productive response of the systems, following the implementation of the program. Accordingly, the aim of this paper is to characterize the economic ad productive behavior of dairy farms integrated to PROGRAM in the province of Camagüey, Cuba.

MATERIALS AND METHODS

The study was conducted in the 2009-2013 period; it comprised 10 dairy units from four provincial companies (Table 1). The representative soils used were brown with typical carbonate, non-glay plastic dark, brown without typical carbonate, and reddish-brown fersiallitic (Hernández, 1999). The mean rainfall is 1 114 mm, with 22 % in the dry season (172.5 m), and 78 % in the rainy season (941.6 mm) (Anon, 2003).

Working methodology

The units selected were part of the Municipal Cattle Programs (PROGRAM), integrated in three stages: (I) Characterization of faults in the production systems through diagnostics to production units, with the application of surveys and using official available recorded data, and onsite inspections. (II) A proposal for technology acceptance, including organization of production systems, promotion of technological solutions and training was made. (III) Follow up and evaluation of re-

sults through production-economic indicators, proposed by MINAG to control dairy units. Forage balances were made using the methodology proposed by Álvaro and Ruiz (2011) and the forage and pasture physical structure was designed in each unit, according to the results achieved by REGPAST (1999).

A matrix was designed with data and variables analyzed in each of the monitoring stages. The methodology used by Toro (2011), based on three phases (reviewing and variable selection, main component analysis, and conglomerate analysis was applied. SPSS version 10 was used in the study.

RESULTS AND DISCUSSION

The results from the diagnostics (stage I) had the following mean values in relation to each unit´s total area: 74 % of native pastures, and 19 % of improved pastures. Forages only accounted for 1 %, including sugar cane and *Pennisetum purpureum* cultivars, CT-169, and purple Taiwan grass. In some units there are no areas assigned to this activity. Weeds comprised 5 %; only five units were cleared of them. In terms of management, the total stocking rate varied from 0.6 to 1.8 LU/ha, and the number of enclosures, from 0 to 48 for a unit.

In stage II, the systems were arranged according to forage balance and the application of a program for pasture localization, REGPAST (1999) planting and completion per sugar cane, CT-169, and *Leucanena leucocephala* area units. The stocks were thick, following recommendations from the Institute for Pastures and Forages (2003), and the rehabilitation of native pastures and planting of improved species, such as guinea grass (*Pannicum maximum*, Jack) Likoni cultivar, pangola grass (*Digitaria decumbens*, Stent) were implemented too. Another recommendation was to introduce *Brachiaria hybrido* cv Mulkato I, and Brachiaria cumbens cv Basilisk, tested and recommended by Cruz (2011) for edafoclimatic conditions in the location studied.

Moreover, the global stocking rate (LU/ha) was reset to under 1.5 LU/ha per dairy farm, recommended as optimum for these conditions, according to Valdés (2014).

Table 2 shows the results for the indicators assessed in the farms. The production results will increase due to the response observed in feeding and handling condition improvements. For the economical type, the cost per liter goes up, determined, among others, by program implementation and input purchases. On cost per Cuban peso, a stable decrease below one is observed, mainly because in spite of the expenses made, production and quality increases determined cost-effectiveness and profits in the systems.

The main component analysis for the selected indicators (Table 3) produced five groups, which explained 89 % of total variability. The first one was determined by productive indicators and training; the second was determined by forages; the third, by natality; and the fourth and fifth, by deaths and cost per Cuban peso, respectively. All the indicators were present in at least one component, which demonstrated the importance of selection and their influence on the systems studied.

Conglomerate analysis showed the most significant results; the solution was given in three groups, following completion of developing programs (phase III). The best results (three units) were gathered in the first group; the second had the lowest values (four); and the third one was in the middle (three). The first group reached 1 553.0 kg/ha of milk; yields per cow were 7.3 L per cow. Additionally, the cost per liter is 0.3, and the cost per Cuban peso was $ 0.31. Concerning the second group, milk production per hectare was 874.25 kg, and 5.34 per cow. The cost of milk liter is CUP $ 0.95, and CUP $0.63. In the third group, production per hectare was 1361.67 kg, and 6.37 L per cow. The cost per liter was CUP $ 0.67, and the cost per Cuban peso was CUP $0.61.

CONCLUSIONS

The farm´s productive and economic indicators were observed to grow in the farms included in the program.

The indicators selected determined variability of the systems; all of them were included in at least one component.

Representative groups of dairy farms were obtained, corresponding to developing programs for each of them.

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Table 1. Company farms selected in the province

Entity	Farm	Entity	Farm
Agricultural Jimaguayú	5-27, 5-30, 10-14,10-13	Agricultural Camagüey	16-312, 19-314
Agricultural Najasa	45-429, 45-432	Triángulo 5 Cattle Company	1-15, 1-3

Table 2. Average production results achieved at the beginning and end of the period

Indicators	Start	End	SD ±
Natality (%)	69.4	77.3	5.6
Total milk production (kg)	855.5	1218.4	256.6
Liter/cow (kg)	4.8	6.3	1.0
Cost of liter (Cuban peso)	0.59	0.83	0.2
Cost per Cuban peso	0.65	0.53	0.1

Table 3. Main components selected, self-expression values, variances explained and gathered, and variable correlation coefficient with every factor gathered

CP	Self-expression value explained variance % gathered variance %	Variables	Correlation with the factor
1	3.5 22.3 (22.3)	Milk production per hectare (kg) Liters per cow per day (kg) Percent of cultivated pastures (%) Number of enclosures Training	0.92 0.73 0.69 0.68 0.57
2	2.8 20.1 (41.0)	Sugar cane area (%) Cost of liter (Cuban peso) Areas for other forages Total stocking rate (LU/ha)	0.84 0.71 0.69 0.64
3	2.4 17.7 (58.7)	Natality (%) Area for native pastures (%) Area with weeds (%)	-0.80 -0.67 0.52
4	2.1 15.2 (74.0)	Deaths	0.77
5	2.1 15.0 (89.0)	Cost per Cuban peso	-0.58

Table 4. Tabla 4. Classification of entities

No	Farm	Group I	Group II	Group III
1	5-27			X
2	5-30			X
3	16-312			X
4	19-314	X		
5	45-432		X	
6	45-429		X	
7	1-15	X		
8	1-3	X		
9	10-14		X	