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Bio-economic Impact of Strategic Changes in Murrah River Buffalo Management

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ABSTRACT

The aim of this paper was to evaluate the effects of changes in the strategy to manage the bio-economic efficiency of a Murrah Buffalo production system in the province of Camagüey, Cuba, located 21º north and 77º west, 217 meters above sea level. The climate is tropical humid (Aw) of plains. The mean annual precipitations were 1 180 mm (71% between May and October), the temperatures were between 24 and 29 °C. The soil is brown, without carbonates, and brown-red fersiallitic. The system comprises 5 100 ha and has 536 workers/year. A strategy to introduce management changes in agro-technical, food, reproductive, replacement, health, salary policy, and training was implemented as part of an innovation package with a systemic and participatory approach. The evaluation lasted eight years, and it was critical to increase dairy production in more than 200 000 kg/year in 2012, in comparison to 2004, with improvements in natality and reduction of operational expenses of the system. It was concluded that the strategy had a determining effect on the system's indicators.

Key words: *Bubalus bubalis, strategies, training, cooperative, innovation, efficiency*

INTRODUCTION

In the last decades, buffalo breeding has become an alternative to milk and beef production due to greater adaptability than cattle to infertile lands, its rusticity, and capacity to make better use of native grass. In many regions, buffaloes have been reported to match or perform better than the local cattle, in terms of growth, environmental tolerance, health, and beef and milk production. The previous indicates the importance of this resource in tropical and temperate regions in different parts of the hemisphere (Fundora and González, 2001; Mudgal, 2010).

Fundora and González (2001) pointed out that this species is well known, and the results achieved in this area have shown its development and true potential as a source of labor and nutrition. Although there are still technological deficiencies that can be corrected, buffaloes are a viable alternative to mitigate the adverse situation of cattle raising in tropical countries, and increase food production with high nutritional and therapeutic values at competitive costs; in that sense, Cuba is not the exception.

Buffaloes are dairy animals with a proven feasible alternative for milk production in Camagüey, Cuba. The effects of strategic changes implemented in the main local buffalo raising company have not been quantified so far; neither has the system shown greater bio-economic efficiency. Therefore, the aim of this paper was to evaluate the effects of the strategy of operational changes on the bio-economic efficiency of buffalo production systems at the Maraguan Cattle Raising Company, in Camagüey.

MATERIALS AND METHODS

This research was done at the Maraguan Cattle Raising Company, located on the easternmost part of the municipality of Jimaguayu, Camagüey. It is located on 21º north latitude and 77º west longitude, 217 m above sea level. The climate is tropical humid (Aw) of wavy plains and low hill chains, with seasonal humidity. The annual precipitations mean of the experimental period was 1 180 mm (71% from May to October), and the

highest temperatures varied between 24 and 29 °C. The predominant soil is carbonate brown, and brown without carbonates, and brown-red fersiallitic (Hernández *et al.*, 2012).

The system encompasses 5 100 ha. Undesirable woody plants cover 60% of the area, especially sickle bush (*Dichrostachys cinerea*). The average number of workers is 536, whose mean salary is $218.00 CUP ($1 USD=$25 Cuban Pesos). The annual commercial production accounts for $275 000 CUP, which underwent $1.8 million pesos in losses, between 1996 and 2004. The population consists of 255 buffaloes and 1 150 heads of cattle (Table 1). This research lasted eight years, with a dynamic evaluation every two years. Only river buffaloes were used (crossbred 95% Murrah)

A strategy to introduce management changes (ECAMAN) was implemented as part of an innovation package with a systemic and participatory approach, which was based as follows:

1. A baseline diagnosis with a participatory approach of the production system was performed, using the Rapid Rural Appraisal technique (Rolling, 1999).
2. The diagnostic results and the new guidelines for animal breeding and well-being were the groundwork for strategic planning, consisting of a series of meetings of laborers, technicians, and the board of directors in every key management area.
3. The purposes, priorities, mechanisms, production goals, and reasonable deadlines to implement the strategy, were discussed.
4. A periodic control mechanism was set up during the implementation of management changes within the strategy, and its impact was measured through bio-economic and social and environmental indicators.
5. Training actions were carried out at every level, concerning organization, pastures, feeding, reproduction, cattle economy, and health of buffaloes.
6. The results were analyzed twice a year by comparing the most outstanding farms.
7. The females were allowed to reproduce from 14 months of age (60 females/stud) on, each 300 kg minimum mean weight.
8. Behavioral test to male buffaloes
9. Selection of female offspring from high yielding cows.
10. Implementation of general dehorning and castration at 10 days of age.
11. A dose of commercial antiparasitic medication Labiomec was administered to each calf in the first days after birth; a second shot was supplied at 4-5 months of age.
12. Sickle Bush (*Dicrostachys cinerea*) and other woody plant species were collected to be used as hedges.
13. The presence of pastures and forages was increased, by introducing new varieties of *Pennisetum* and *Panicum*, and the area was enclosed with electric wires.
14. The studs were replaced every two years, before August.
15. The animals were weighed using a tape measure, following the Venezuelan Chart, with 18% deduction.
16. Jobs were restructured, particularly non-productive occupations; and a novel paying system was applied.
17. Different indicators were measured, such as, milk production (thou. kg), total of milking cows. Prod/day/year (kg), total deaths (No.), deaths of herds (No.), births (No.), cows in reproduction, total herds.

Statistical analysis

To evaluate the impact of the strategy to transform management of productive indexes (individual production), simple ANOVA was performed, using SYSTAT 12.0 (Wilkinson, 1998).

RESULTS AND DISCUSSION

River buffalo systems have increased their interest, and have significantly spread out in the last 15 years in Latin America. Thus, countries like Brazil, Venezuela, Colombia, and Cuba (the largest increase as to total animals and herds) attribute it to the species´ high adaptive capacities, which may beat bovines and other ruminants in adverse edaphoclimatic conditions. Buffaloes are known for their fertility, response to supplements, high food conversion, and economy of resources, for

sustainable production (Bernardes, 2007; Mudgal, 2010).

When the buffalo program was started at the company, the production strategy was poorly organized, only based on the etiology. Eventually, the differences between bovines and buffaloes have been acknowledged, along with, proper husbandry (Fundora and González, 2001). At the beginning, only 338 l of milk were produced by 54% of the cows; 2.0 t of meat were produced by animals weighing 275 kg on average; and natality was 59%, which were very low indicators for the species. The economic losses were $1.8 MM CUP, and income was $275.0 M CUP.

In 2004 (Table 2), the workers reported that the company was run according to the basic principles of a cattle company. Consequently, their results failed to show a favorable bio-economic situation, regarding the production area and the number of animals. After changes in the latter indicator during the last years of evaluation (Table 3), efficiency and production increased, creating a positive scenario of the production economy.

The above-mentioned response coincided with reports from several studies in Latin America and the Caribbean, where the adoption of some technologies or experimental tests of some aspects of production have had sensitive positive effects on Murrah buffaloes, as in the works of Fundora and González (2001) in Cuban herds, and Mudgal (2010), in India.

Without a doubt, the previous is a reflection of the strategies designed and implemented by the board of directors of the company and rural extension, combined, along with farmers. It coincided with the results of this study, as it comprised commercial herds, rather than comparisons of treatments in which single differences are the key results. Instead, this work was based on a group of systemic components with a high value regarding the implementation of strategic alternatives with a systemic approach.

In the fourth two-year period (2010-2012) (Table 3), mean values of 2.91 kg per milking cow; 0.46 mortality; 90% natality; 30.7 t of meat; and 326 kg/animal, were recorded, as a result of improvements in resource management and animal husbandry. Other authors have dealt with different aspects, like changes in grazing methods, seeking more rationality (Voisin grazing), activating nitrogenized supplementation, and including sugar cane as forage in Venezuela, Brazil, and Cuba (Fundora and González, 2001).

The changes implemented after 2004 in terms of reproductive management of studs, and the incorporation of cows at 14 months of age, made clear differences from cattle breeding. As a result, management strategies to enhance their qualities were implemented, which coincided with the findings of Fundora and González (2001) in Cuba; and Charlini and Sinniah (2015), Rajagopal (2008), and Anitha *et al.* (2011) in India, in terms of incorporation of females, their body condition, and regulation in the number of males per females and/or necessary inseminations per gestation.

Table 3 shows that the new strategic changes in production incremented natality. The mating season lasted less than 90 days in more than 85% of the cases. Male fights over mating were reduced, and a large number of gestations and calving were programed for later months. Although seasonal strategies can be considered, their effect was not demonstrated.

The results of this study suggest beginning reproduction at 24 months of age to guarantee massive reproduction with more mature animals. If these conditions are met, the animals will be ready to start mating. In practice, the males were incorporated about a month after a group of cows had calved, and waited for a new reproductive cycle.

Campo, Hincapié, Quesada, Fundora, Herrera and Alonso (2005), Hurtado, Cerón and Valencia (2006), and Fundora and González (2001) corroborated the results achieved with the change of strategy for buffalo breeding. They studied the effects on improvements in forage and general nutrition in buffalo systems of tropical areas in Latin America, like Cuba, Colombia, Brazil, and Venezuela, which led to increased dairy and meat yields over 1.5 kg/milk/day.

Concerning the previous, the results achieved, other than the reproductive changes, and the important role of using females calved from high-yielding cows, derived from changes implemented in animal nutrition. This strategy improved consumption and the nutritional contribution remarkably, with ensuing high yields of animals and areas. It was validated by the system's efficiency in relation to better bio-economic indicators, and resilience after a critical stage (Martínez, 2006).

An additional but equally important point is the improvements in the reproductive and genetic response of herds after the implementation of the new strategy, which coincided with positive effects observed in that direction (Andrighetto *et al.* (2004); Hurtado-Lugo *et al.* (2006); Aspilcueta *et al.* (2007); Malhado *et al.* (2007), and Agudelo, Hurtado-Lugo and Cerón-Muñoz (2009), who estimated production peaks and favorable results in buffalo lactation following changes in technology, including the evaluation of response to lactation in some cases.

Accordingly, Tonhati *et al.* (2000) reported 1 259 kg of milk, somewhat below the reports of Amorim *et al.* (2006), and Malhado *et al.* (2007) in Brazil, who reported milk production means of 1 650 ± 687 kg, and 1 864 ± 677 kg; and by Kansana and Sinniah (2012), in India, with over 1 200 kg. In all the cases, higher values corresponded to strategic programs for dairy control, reproduction, and genetic breeding programs implemented several decades ago in these countries.

CONCLUSIONS

Largely, the application of changes in agrotechnical management of pastures and forages, supplemented feeding, salary policies, training, and reproduction, had favorable and determining effects on the main productive indicators, such as, cattle population, reproduction, and economy, using Murrah buffaloes in the period studied, in Cuba.

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Table 1. State of herds at the Livestock Company in 2004

Animal category	Quality and age in months	Heads
Buffalo calves	up to 12 months	64
Female buffalo yearlings	13-24 months old	36
Young females	24 months old to calving	53
Buffalo females	from first calving	165
Male buffalo calves	up to 12 months	73
Male buffalo yearlings	13-24 months old	38
Young buffalo bulls	24-month old castrated males	19
Buffaloes	Studs ready for reproduction	3
Laboring buffaloes	Tamed buffaloes for farm labor	10

Table 2 Dynamics of productive indicators on the farm (2004-2012)

Production indicators	2004	2006	2008	2010	2012	Dif. 2004-2012 (+, -) *
Milk production (thousands, kg)	25.0	100.8	229.0	236.2	245.1	+220.1
Total milking cows	40	95	188	196	224	+184
Prod/day/year (kg)	1.71[c]	2.91[c]	3.34[b]	3.81[a]	4.19[a]	+2.52
Total deaths (No.)	2.0	6.0	1.0	1.0	2.0	-
Deaths of herds (No.)	1.0	1.0	6.0	4.0	3.0	+2.0
Births (No.)	44.0	55	59.0	72.0	85.0	+41
Reproduction cows	74.0	159	221.0	267.0	283.0	+209
Total buffalo herds	255.0	1 296	2 062	2 109	2 131	+1 870

Table 3 Annual reproductive results after the implementation of technological changes in the company

Year	T/females	Buffalo cows	H/plan	Births (No.)	Natality (%)
2004	148	74	74	44	59
2006	482	282	282	175	62
2008	832	387	359	255	90
2010	1 174	533	444	367	95
2012	1 371	662	621	519	97