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Fattening Commercial Zebu with Grazing and Low Supplementation on Small Farms

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ABSTRACT

The aim of this paper was to describe and group grazing commercial Zebu bulls, with low supplementation. Forty-four beef-producing farms from several cooperatives of credits and services were studied. Their members are private farmers from Sibanicu, Camaguey, Cuba. The farms were visited for three years, and official records were made of each farmer for these variables: resources, animals, management, production, and economy. The main statigraph for the variables were calculated. The average initial weight, final weight, weight gain, and production per ha were, 202.6; 371.6; 501; and 326.2 kg, during 339.7 fattening days, respectively. The principal component analysis (PCA) showed a Kaiser-Meyer-Olkin coefficient higher than 0.66, and a significant Bartlett sphericity coefficient ($P < 0.01$), with self-values above 1. The two groups were made using a BIETAPIC cluster analysis.

Key words: *herds, bulls, fattening, principal components, cluster*

INTRODUCTION

Over the last four decades of the Twentieth Century, small cattle farm holders (less than 65 ha) were involved in milk production, or had dual purpose production, with minor inclusion of beef production. Their animal sales included mostly discarded cows, few young males lacking meat formation, and old studs.

In the early 2010s, a national movement was started that has managed both fattening and improving state-owned facilities in Cuba. Many farmers in private cooperatives were committed to bull fattening as their main economic activity. alongside bull fattening (Muñoz, 2012).

There are several reports on the characteristics of Cuban dairy systems (Guevara *et al*., 2004; Martínez *et al*., 2011), but it is important to set up the specifications of the new facilities for beef production, in order to improve them and access benchmarking information of the changes and possible results. Descriptions of small bovine fattening grazing systems in the tropics have contributed to improvements.

The aim of this paper was to describe and group commercial Zebu bull farms with grazing and low supplementation.

MATERIALS AND METHODS

Forty-four beef production farms in cooperatives of credits and services, with a private work force, were studied. The farms were located on these coordinates, latitude and longitude, 21.23-77.52, less than 300 m above sea level, in pratense savannahs, municipality of Sibanicu, province of Camaguey, Cuba. The farms were located on inceptisol and mollisol soils (Hernández *et al.*,1999).

The weather includes a rainy season in May, with over 70% of annual precipitations, ranging between 1 200 and 1 400 mm. The dry season extends from November to April, with only 35 mm monthly. The mean temperature is 25ºC, ranging between 22.4 and 27.9 ºC.

The main statigraphs were calculated for the variables studied. Principal Components Analysis (PCA), with rotation (Varimax) of variables with the highest variation coefficient and significant correlation coefficients, was made for multivariate analysis. PCA had a Kaiser-Meyer-Olkin index higher than 0.66, a significant Bartlett sphericity coefficient ($P < 0.01$), and self-values above 1. All the initial variables had loads higher than 0.5, or lower than -0.5.

Two-step cluster analysis showed the conglomerates and a cohesion and separation mean for clusters over 0.5. SPSS for Windows (2.1) was used for all the analysis.

RESULTS AND DISCUSSION

The most dispersed variables were related to forage areas, fuel costs, concentrated feeds, units of large animal fattening, total kg sold, and kg produced per ha.

The farm areas are small, with few enclosures. Shading is acceptable, but can be improved further. Only one farmer manages fattening, and the stocking rate is relatively high, considering the low-quality grass. Additionally, the area for biomass bank per bull is poor.

In this study, bovines started fattening over a year of age, higher initial weights, and equal finishing time to young Zebu males that started behavior tests weighing 162.2 kg live weight on average (Menéndez *et al*., 2006). Those authors reported individual final weights of 346.1 kg, with a variation coefficient of 18.9%. The tests were made while grazing, and the supplementation conditions were above commercial fattening.

Díaz *et al.* (2009) observed crossbred bovines (5/8 Holstein x 3/8 Zebu), forest grazing on *Leucaena leucocephala*, with access to biomass banks, mean daily gain of 0.739 kg in the control treatment, and 0.776 kg after adding a ruminal activator in the diet. At the beginning, the animals compared had 291.0 ± 4.00 kg live weight, similar to the ones used in this study. Xie *et al*. (2012), when comparing the local breeds to other imported breeds in traditional Chinese systems, found gains of 0.78 kg in the local animals. The imported animals had 1.20 kg.

With the exception of a few isolated cases, most farmers who come close to 1 000 kg/ha have very low production per ha, the genotypes used are not suitable, and growth and fattening are very slow. Stejskalová *et al.* (2013) reported 1 671 and 1 332 kg/ha for grazing Czech CSS and RSS, which consumed grass with irregular quality.

Concentrated feed consumption by bovines was insufficient to achieve further weight increases. Ogino *et al*. (2007) supplemented Japanese beef bovines with 2 - 2.3 kg of concentrated feed since they reached 191.7 and 223 kg live weight. During whole analysis of relative variable significance, the five variables studied through factorial analysis showed that only 15 animals had a relevant weight.

Five principal components with self-values over the unit were achieved. The first three accounted for more than 50% of total variance (Table 1). Overall, the five components accounted for 77.4% of total variance, which is acceptable to characterize grazing bull fattening systems. The first three components showed a practically similar variance percent.

The first principal component ─close to a fifth of the total variance observed─ was positively correlated with the number of fattened bulls (LU), the kilograms of total live weight sold, and the number of enclosures on each farm. This factor would indicate the system´s dimensionality. Cortés *et al*. (2011), reported two principal factors that accounted for 93.34% of total variance of the bovine system studied (economic-entrepreneurship capacity (EEC), technological capacity (TC)).

The second component (system´s productivity and intensity) was determined positively by the weight achieved over fattening per hectare (kg/ha), and the stocking rate (LU/ha). Moros and Busqué (2014), in Cantabria, determined three principal components in fattening cattle: suckler cows cows, management intensity and stocking rate, in relation to quality grass. *----+--

The third principal component was related to concentrated feed and forage supplementation; sugar cane and king grass areas (*Pennisetum purpureum*) to fattening bulls; sugar cane (*Saccharum officinarum*) per livestock unit; kingrass area per livestock unit and kilograms of concentrated feeds (supplemented) to reach each kg of weight gain during the fattening period. The absence of a legume complement in the bull diet limits the system´s yields. Cino *et al*., (2006) found positive economic results during experiments with cattle fattening in forest-grazing systems, based on *Leucaena leucocephala*.

The fourth principal component was strongly and positively correlated to daily weight gain, and final individual animal weight gain. This factor defines the growth rate for higher final weights in equal fattening periods. The variables studied on each farm showed low variability; however, they had about 10% total variability, and were included due to their importance for fattening. Low variability is associated to a decision agreed after discussions among farmers, and limitations in acquiring the agreed amounts of concentrated feeds from the state owned company.

A case studied made on a commercial farm by Iglesias, García and Toral (2014), on different bovine genotypes grazing as a group on graminaceae areas, during the day, with added amounts of mineral salts, 1 kg of maize still residues, and 1 kg of wheat bran, respectively, in the afternoon-evening, in sheds. Final weights of 260.0; 263.0 and 241.0 kg were achieved for Zebu, Holstein and Mambi, respectively. Live weight gains went over 0.620 kg/d. The concentrated feed supplementation and wheat bran values were higher than the ones from the farms studied.

The fifth principal component pointed to water and shade needs. The correlation of variables was positive: number of windmills for water collection and plenty of shaded areas. This component speaks for animal welfare.

The farms studied were pooled in two gruops (Table 2). Group 2 accounted for 15% of the total number of units, with greater dimensions, doubling area surface, the number of fattened bulls, and enclosures. Additionally, the number of units based on human work are 50% higher. A higher stocking rate was also observed.

The group´s productivity per hectare was 160 kg higher than for group 1, though it is still low in comparison to other systems, as reported by Stejskalocá *et al*. (2013). It is mainly caused by the low contribution of concentrated feeds, when compared to traditional systems in many other areas, which may not be high, but still double the findings (Ogino *et al*., 2007).

Concerning productivity/man, it was twice as much efficient, and only a fourth of the fuel used by the other group was consumed; hence, the previous results are better.

CONCLUSIONS

Group 2 had greater surface area, more bulls, enclosures and stocking rate; as well as more productive efficiency per hectare and farmer.

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Table 1. Results of principal component analysis

Component	Variables	Correlation	Total variance per-cent
I	Livestock units (LU)	0.88	
	Total weight sold (kg)	0.87	18.7
	Number of enclosures (u)	0.82	
II	Weight gained during fattening per ha (kg/ha) at fattening start	0.84	
	Stocking rate (LU/ha)	0.79	18.0
	Area per human labor (ha/HL)		
	Fuel per hectare (kg/ha)	-0.76	
		0.60	
III	Sugar cane area per LU (ha/LU)		
	Concentrated feed per kilogram sold (kgconc/kgsold)	0.75	
	Kingrass area per livestock unit (ha/LU)	0.71	
	Fuel consumption per hectare (kg/ha)		17.2
		0.71	
		-0.70	
IV	Daily weight gain (kg)	0.93	
	Average final individual weight	0.92	12.4
V	Shading (u)	0.82	
	Number of wind mills (u)	0.77	11.1

Table 2. Pooling of beef production farms

Variables	Group I (34 UPC)		Group II (6 UPC)	
	Mean	Standard error	Mean	Standard error
Area (ha)	15.8	1.02	33.2	4.59
Livestock units (LU)	28.1	1.54	66.7	6.25
Stocking rate (LU/ha)	1.9	0.10	2.2	0.32
Enclosures (u)	1.2	0.82	2.2	0.31
Weight gained during fattening per ha (kg/ha) at fattening start	402.4	27.01	560.3	78.36
Total kilograms sold (kg)	10636.4	599.6	25443.0	2602.8
Weight sold per farmer (kg/HL)	4789.2	260.4	8966.5	873.94