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Non-genetic Factors in Four Buffalo (*Bubalus bubalis*) Herds. I. Growth Features

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ABSTRACT

Non-genetic growth features in four buffalo herds at the *Ruta Invasora* Cattle Raising Company, in the province of Ciego de Avila, Cuba were assessed. Data from 120 buffalo cows were collected (1994-2007), and processed by SPSS 15. At herd integration, the results from growth features were, live weight (384.1 ± 3.45 kg); age at integration (28.5 ± 0.78 months) and weight forage (467 ± 12.9 g/days). The effect of herd and birth year had a significant influence ($P < 0.01$) for the growth features at integration.

Key Words: *buffalo, growth features at integration*

INTRODUCTION

Buffalo population has grown very fast, ranking second in terms of milk production. Additionally, its meat is equally appreciated for its high quality. Other buffalo productions include skins, horns, bones and manure as organic fertilizer, according to FAO reports (2002). Rusticity is one of the most important features of the species, as it has the ability to adapt to different climatic regions, and have high fertility rates, even higher than bovines (Lourez, 2001).

Méndez (2007) considered that buffalo raising is another option for milk and meat productions, because animal growth, environmental tolerance, health and production, increase vertically. Besides, mortality is very rare in the species, due to high disease resistance and a high reproduction rate. Both factors make the buffalo business very profitable in every environmental setup, with a minimum of investment for exploitation.

Herd growth depends on complex interactions between the environment and the animal genotype, especially in tropical ecosystems; they may be affected by the environmental conditions caused by handling, season and year of birth (Ceró *et al.*, 2011; Fraga and Ramos, 2011).

The purpose of this paper was to assess the non-genetic factors of growth features during integration to buffalo herds in the province of Ciego de Ávila, Cuba.

MATERIALS AND METHODS

The study was performed to 120 buffalo cows (River Buffalos) in four units of the *Ruta Invasora* Cattle Raising Company, in Ciego de Avila, between 1994 and 2007.

The herds are being raised with the calf, grazing on native and planted grass, weaned at 6-8 months of age. Milking takes place once a day, between 4:00 to 6:00 am.

According to the Cuban Genetic Soil Classification (CITMA 2003), the soils are brown, with carbonates. Water supply is produced by windmills and electric pumps lined up to elevated metal tanks.

The data (date of birth, date of integration to reproduction, age and weight at integration, and calving date) were collected from individual control of reproduction at the four units studied.

The data from 120 cows in four herds of dairy River Buffalo herds between 1994 and 2007. Weight forage (PPE) was calculated according to the following formula.

$$PPE = \frac{PVI}{EI} \times 1000$$

Where,

PPE: weight forage.

PVI: live weight at herd integration.

EI: age of herd integration.

To calculate the growth features and the effects of non-genetic factors affecting them, SPSS (2006), version 15, was used to calculate the basic Statgraphs.

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The causes of variation applied in the mathematical model for the growth features were, herd (4), birth season (2) and year of calving (14). Season one comprises November-April (dry); and season two, comprises May-October (rainy).

The following model was used,

$Y_{ijkl} = \mu + R_i + E_j + A_k + e_{ijkl}$

Where:

Y_{ijkl} = dependent variable of live weight, age and weight forage at integration, corresponding to the i th individual of the ijkl th subclass.

μ = general mean.

R_i = herd effect (i = 1…..4)

E_j= birth season effect (j = 1, 2)

A_k= calving year effect (k = 1…14)

e_{ijkl}= residual effect or experimental error.

RESULTS AND DISCUSSION

Growth features at integration

Table 1 shows the growth features significantly affected at integration ($P < 0.01$), by live weight, age and weight forage, under the influence of herd and year of birth, on the birth season.

Average live weight during integration was 384.1 ± 3.45 kg (Table 1),within the scope of SCCB (2002) of 365 - 385 kg in the country; as well as findings by Linares (2008),with values between 359 - 391 kg in Venezuela; and Ceró *et al.* (2011), in the province of Camagüey, accounting for 352 - 390 kg. These parameters were higher than García (2002), with 340 kg; and lower than Barusselli *et al.* (1993), with 400 kg in Brazil.

The average age at integration was 28.5 ± 0.78 months (Table 1), higher than the one achieved by Barusselli *et al.* (1993), Amorim and Fraga (2010), and Ceró*et al.* (2011).These results are similar to reports by Baruselli *et al*. (1993), who said that buffalo calves that undergo nutritional limitations during suckling and breeding, and calves that fail to reach proper weight, show low estruss when they are submitted to mating, leading to delays in the first mating. However, García (2002) and Campos *et al.* (2004) considered the possibility to achieve the desired values for that feature at ages 18-22.

Weight for average age at integration-was467.2 ± 12.9 g/days (Table 1), below the one achieved by Barusselli*et al.* (1993); García (2002); SCCB (2002) and Linares (2008), with 526; 566-515; 568-521; and 727 g/days, respectively, under tropical conditions.

Producers and researchers in Latin America consider 500g/day adequate forth at feature. That indicator has been affected by inadequate management and feeding practices that effect on daily weight gains (López, 2010).

The behavior of herds for live weight, age and weight forage during integration (Table 2) is within the parameters cited in the literature, but the fourth herd differs significantly ($P < 0.05$) from the others. That result may be influenced by nutrition, stabling, existence of water reservoirs, natural shade and water supply, according to Fundora and González (2001), and García (2002). In addition to it, Padrón *et al.* (2010), noted the influence of conditions on pasture quality and availability, management, nutrition and farmer training; as well as training of all staff that works in the dairies.

Years of birth

Table 3 shows significant differences ($P < 0.05$) between growth traits at integration for the birth years studied (1994 - 2007), though there is a generally stable behavior. The year 1994 was notably different, moving away from the means achieved in the study, and because of the375 kg referred to as acceptable value for the country´s conditions SCCB (2002).

In Table 3, the birth year forage at integration had a general different behavior between 2005 and 2007. In this period a favorable decline is observed, close to values cited by several researchers (García, 2002 and Campos *et al.*, 2009), that include the results of 18 – 22 months for that indicator.

At this point, it must be noted that the dairy staff has improved their skills (below the expectations) through training, in terms of buffalo calf management, and handling of Buvillas for replacement, along with better nutrition provided to the animals in that stage. Moreover, personal incomes have increased as a result of higher production.

Regarding the year of birth for the weight for integrating age during the study (Table 3), there are significant differences ($P < 0.05$), as the period 1996-2004 has been stable, within 427-480 g/days, lower in 1994-1995, and higher than the average values for 2005-2007, exceeding 500 g/days.

CONCLUSIONS

Non-genetic factors like herd and year of birth proved to have significantly influenced ($P < 0.01$) the growth traits at integration; therefore, they must be taken into consideration when studying buffalo herds.

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Table 1. Variance analysis results for the growth features at integration

Variation sources	Live weight (kg)	Age (months)	Weight forage (g/days)
Herds	**	**	**
Birth season	NS	NS	NS
Birth year	**	**	**
$\overline{X} \pm ES$	384. 1 ± 3.45	28.5 ± 0.78	467.2 ± 12.9
R^2 (%)	42.7	47.1	43.2

** (P < 0.01)

Table 2. Growth features for the herds studied at integration

Herds	Live weight (kg) $\overline{X} \pm ES$	Age (months) $\overline{X} \pm ES$	Weight forage (g/days) $\overline{X} \pm ES$
1	381.6 a ± 3.44	29.7 b ± 0.78	447.6 a± 12.9
2	382.3 a ± 3.44	30.2 b ± 0.78	443.4 a ± 12.9
3	380.2 a ± 3.45	28.5 b ± 0.79	464.8 a ± 12.9
4	392.1 b ± 3.51	25.9 a ± 0.80	513.1 b ± 13.2

Means with different letters on the same column differ significantly (P < 0.05). Tukey Test

Table 3. Growth features for the birth years at integration

Birth years	Live weight (kg) $\overline{X} \pm ES$	Age (months) $\overline{X} \pm ES$	PPE (g/days) $\overline{X} \pm ES$
1994	361.9 ^{a} ± 7.75	33.1 ^{a} ± 1.79	398.8 ^{a}± 29.1
1995	393.6 ^{b} ± 9.98	31.6 ^{b} ± 2.27	408.2 ^{b}± 17.6
1996	394.6 ^{b}± 4.70	31.5 ^{b} ± 1.07	427.3 ^{bc}± 37.4
1997	398.9 ^{b} ± 8.17	31.4 ^{b} ± 1.86	431.5 ^{bcd}± 30.6
1998	397.1 ^{b} ± 8.01	31.3 ^{bcd}± 1.83	430.1 ^{bcd}± 30.1
1999	392.3 ^{ab} ± 4.41	28.6 ^{bcd}± 1.00	463.3^{bcde}±16.5
2000	387.8 ^{ab} ± 3.64	28.3 ^{bcd}± 0.83	458.2^{bcde}±13.7
2001	392.2 ^{ab} ± 5.20	28.0^{abc} ± 1.19	471.6^{abcde}±19.5
2002	397.1 ^{b} ± 3.56	29.3 ^{abcd} ± 0.81	464.2^{abcde} ±13.4
2003	403.1 ^{b} ± 7.75	31.9 ^{cd} ± 1.77	431.0 ^{abcd}± 29.1
2004	391.1 ^{ab}± 4.28	27.6 ^{abcd} ± 0.97	480.3 ^{abcde}± 16.0
2005	394.5 ^{b} ± 3.62	25.7 ^{ab} ± 0.83	508.6 ^{cde}± 13.6
2006	385.2 ^{b} ± 9.95	23.9 ^{ab}± 2.27	535.6 ^{de} ± 37.3
2007	396.3 ^{b} ± 6.93	23.3 ^{a} ± 1.58	558.7 ^{e} ± 26.0

Means with different letters on the same column differ significantly (P < 0.05). Tukey Test