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Full Length Research Paper

Preweaning growth performance of Lagune cattle in Benin

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The aim of the present paper was to evaluate the birth weight (BW, kg) and weaning (WW, kg) weight and the corresponding average daily gain (ADG, g) of Lagune cattle reared in the Samiondji breeding farm of Benin. A total of 1,414 records from 707 calves, born from 1997 to 2003, were analysed using a general linear procedure (proc GLM). Fixed factors were sex, calving number and year of birth. The weaning age (WAGE) was used as variable. Results of present evaluation showed that BW and WW ranged respectively from 11.65±0.20 to 17.40±0.33 kg and from 70.21±0.17 to 117.00±0.20kg while the ADG from 141.18±4.80 to 248.90±6.25g. All fixed effects significantly affected the growth traits, except sex for ADG, and year of birth for BW. The WAGE showed a significant linear relationship with ADG.

Key words: Growth, weaning, weight, Lagune, cattle.

INTRODUCTION

The cattle population of Benin Republic is about 1,400,000 heads (Anonymous, 1998) and comprises two species found in all ecological regions of the country: the *Bos indicus* (7.0%) and *Bos taurus* (93%). The *B. taurus* population in Benin consists of Borgou (34%), Lagune (3.7%), Somba (0.3%) and of various crossbreeds (55%). These cattle might have been introduced from Asian countries through East coast of Africa, from Egypt to Kenya, and one part of them spread between the Sahara and the Atlantic coast to the Guinea coast (Shaw and Hoste, 1987; Rege et al., 1994; Hanotte et al., 2002). Among West and Central Africa cattle breeds, the Lagune has been described as tolerant to trypanosomosis and well-adapted to subhumid tropical area, where parasitic diseases have been reported to be the most important constraint for animal productions (Mortelmans and Kageruka, 1976; ILCA, 1979a, b; Agbemelo, 1983; Adeniji, 1985; Maule, 1990). Since the last decade, however, a drastic diminishing of Lagune cattle has been reported (Shaw and Hoste, 1991) and may become one of the most threatened species of Benin. The declining of Lagune cattle was due to indiscriminate slaughter, inappropriate husbandry techniques, lack of improvement and continuous crossbreeding with zebu breeds for their bigger size and carcass yields. As Drucker et al. (2001) pointed out earlier, 16% of unique adapted breeds have been lost since the beginning of the last century and another 30% are at risk of becoming extinct. Therefore, challenges consist on the sustainable management of the Biodiversity of farm animal genetic resources (Hammond and Leitch, 1996; FAO, 1999).

The advantages to maintain trypanotolerant local breed as Lagune, is the low-input management for smallholder production systems (Falconi et al., 2001). Access to phenotypic or genetic characteristics of Lagune cattle breed would be interesting, not only for restoration, rehabilitation and conservation, but also for genetic improvement program. The recent literature dealing with

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growth performances of Lagune cattle breed is limited,and the objective of this study was to estimate the influence of some non-genetic factor on birth and weaning weight of Lagune cattle reared in Samiondji breeding farm of Benin.

MATERIALS AND METHODS

Description of Lagune cattle

Lagune cattle breed (named Muturu in Nigeria, Mayombe or Dahomey in Democratic Republic of Congo, Lagoon in Ghana), is the dwarf shorthorn breed found in the West and Central Africa throughout the savannah and humid tsetse-infested areas, and undoubtedly the one of the smallest cattle breed in the world. He is usually black or black with white spots, black mucosa, eyelids and hoofs, and has been early described by many authors (Leclercq, 1970; Epstein, 1971; Domingo, 1976; Mortelmans and Kageruka, 1976; ILCA, 1979b; Agbemelo, 1983; Adeniji, 1985; Maule, 1990). The BW range from 9.5 to 12 kg (Lazic, 1978; Adeniji, 1985). The adult weight was 111.0 kg at 1080 to 1440 d (Domingo, 1976); 83 to 87 kg at 360d (Lazic, 1978), 157kg at 1440 d (Agbemelo, 1983) and 96.0kg at 720 to 1080 d (Adeniji, 1985). Domingo (1976) described the height at withers (80.6 to 96.2 cm), heart girth (102.8 to 136.3 cm), scapulo - ischial length (92.3 to 119.7 cm) of Lagune from 1.2 to 5 years old.

Study area and animal management

The study was carried out at the Samiondji breeding farm (2°22 and 2°25 long. E, 7°25 and 7°30 lat. N) located in the Sudano-Guinean zone of Benin. The climate is characterised by a rainy season (June to September) accounting for 75% of the annual rainfall, a short rainy season (February/March to April/May) and a dry season (October to January) as defined by Adam and Boko (1990). Dry season is less favourable for milk production and then for the calf weaning weight. The peak of grass production with a high digestibility occurred in the rainy season (Sinsin et al. 2002). The Samiondji breeding farm focused on breeding registered purebred Lagune cattle. However there is a small dairy unit of crossbred Gudali zebu with Lagune cows lodged in separate paddocks. Cattle were grazed on cultivated and natural pastures. Various quantities of supplements comprising a combination of agricultural and industrial by-products were given. Salt licks and water were supplied *ad libitum*. A routine vaccine inoculation and a regular drenching for ticks control were implemented. Sick animals were treated and necropsy findings were recorded in case of mortality.

Mating of cows occurred twice throughout the year (May-July and September-October) with a ratio of approximately 60 cows per bull (Alkoiret and Gbangboche 2005). Newborns were ear-tagged and weighed within 24 h of birth up to weaning and thereafter. Weaned calves were randomly allotted within sex groups.

Data collection

Birth weight (BW, kg), weaning weight (WW, kg), age at weaning (WAGE, d) and average daily gains (ADG, g) were edited from pedigree information of 707 calves born from 1997 to 2003 in the Samiondji breeding farm of Benin. Each animal has 2 records and the valid 1,414 data were classified according to sex, calf birth year, calving number of cow and exact ages at weaning (WAGE, d). The WAGE was calculated as the difference between a calf's birth date and its corresponding dates at weaning. The average daily weight gains (ADG) were calculated as the ratio (WW-BW)/WAGE.

Statistical analyses

Linear function

General linear model procedure (proc GLM) of the Statistical Analysis Systems Institute (SAS® 9.1) was used to test the significance of fixed effects of calf birth year, the sex of calves and the calving number of cow. The significance level was set at $p<0.01$, and the final fixed model used was as follows:

$$y_{ijk} = \mu + S_i + T_j + U_k + b(x_{ijkl} - X) + E_{ijk}$$

where y_{ijk} is the adjusted BW, WW and ADG of the *k*th calve; μ is the overall mean; S_i is the fixed effect of the *i*th sex (*i* = male and female); T_j is the fixed effect of *j*th year (*j* = 1997, 1998, 1999, 2000, 2001, 2002 and 2003); U_k is the fixed effect of *k*th calving (*l* = 1, 2, 3, 4, 5 and 6); E_{ijk} is the random error attributed to the *k*ith calve. *b* = linear regression of WW and ADG on age at weaning (WAGE), x_{ijkl} = exact age of *k*ith calf (days) at weaning, X = age mean at weaning.

RESULTS AND DISCUSSION

The least square means ± standard errors for BW, WW and ADG in relation to significant fixed effects are reported in Table 1. The obtained ADG mean (183.66±17.83 g/day) in this study was lower than that (263 g/day) of Baoule, N'Dama and Zebu at three months old (Poivey et al., 1987). Youssao et al. (2000) reported an ADG of 246.0±0.9 g/day from birth to three months old, 174.0±1.49 g/day from 3 to 12 months old and 190.0±1.1 g/day from birth to 12 months old; in Borgou cattle. In the comparative study (Table 2), most of the West and Central African shorthorns and Zebu breed were heavier than Lagune breed, and this could obviously due, to the genotypic differences, as the Lagune cattle breed has been considered as the smallest cattle (Epstein, 1971; Domingo, 1976; Mortelmans and Kageruka, 1976). Lower BW than that obtained in this study, however, has been reported for Namchi calves(Ebangi et al., 2002b) and for similar Lagune calves reared on extensive conditions (Domingo, 1976; Lazic, 1978; Agbemelo, 1983; Adeniji, 1985). Such differences may be due to the management practice in Samiondji breeding farm that is expected to improve growth performance.

Effect of year of birth

WW and ADG increased consistently with the year of birth (Table 1). The significant year effect ($p<0.01$) in this study is in agreement with reports in Boran cattle

Table 1. Least squares means of growth traits of Lagune cattle reared in Samiondji breeding farm.

Fixed factors	Number	BW (kg)	WW (kg)	ADG (g/day)
Sex		**	**	ns
Female		13.44±0.37	91.97 ± 0.12	182.05±3.80
Male		15.37±0.20	93.01 ± 0.07	185.28±2.33
Calving number		**	**	**
1		11.65±0.20	89.68±0.30	173.81±3.93
2		13.42±0.50	90.21±0.12	181.46±3.89
3		14.04±0.40	91.84±0.13	186.86±3.88
4		14.25±0.35	94.40±0.16	192.52±4.82
5		15.68±0.30	93.10±0.25	175.92±6.53
6		17.40±0.33	95.70±0.20	191.42±6.42
Year of birth		ns	**	**
1997		13.21±0.20	70.21±0.17	141.92±5.29
1998		14.38±0.18	75.24±0.16	144.18±4.80
1999		14.63±0.16	82.98±0.14	172.58±4.25
2000		14.58±0.15	91.97±0.15	175.65±4.24
2001		14.93±0.16	100.63±0.15	190.55±4.66
2002		14.75±0.22	109.42±0.20	211.88±4.83
2003		14.30±0.20	117.00±0.20	248.90±6.25
WAGE (472.26±16.46d)			ns	**

BW= Birth weight; WW= weaning weight; ADG (g/d) = average daily gain; WAGE = weaning age (days); ** $p < 0.01$; ns = not significant.

(Kassa- Mersha and Arnason, 1986), Hereford cattle (Ahunu and Makarechian, 1987), Simmentaler cattle (Rust and Van der Westhuizen, 1994), Nguni cattle (Kars et al., 1994), crossed Ayrshire, Brown and Swiss cattles (Kahi et al., 1995), Borgou cattle (Youssao et al., 2000) and purebred Gudali and two-breed synthetics Wakwa Beef Cattle (Ebangi et al., 2002a). The effect of year includes several environmental factors as climatic changes, pastures availability, management and administration policies. In Samiondji breeding farm, the level of management and administration policies, such for feeding, has been improved with year and could explain the increasing WW of this study.

Effect of calving number

Females with higher calving number had consistently calves with higher BW, WW, and AGD (Table 1). However, WW and ADG increased trends were not constant from 4th to 6th parity (Table 1). Similar observations have been reported in beef cattle (Jeffrey et al., 1971), crossbred *B. taurus* x *B. indicus* cattle (Reynoso et al., 1987; Baker et al., 1990), Gudali and Wakwa cattle (Abassa et al., 1993) and south-east Mexico cattle (Magana and Segura-Correa, 2006). Njoya et al. (1998) reported a mean BW from 21.1 to 24.7 kg for calves born from first to fifth parity cow respectively. Youssao et al. (2000), has pointed out the effect of age at calving on twelve-month weights and average daily gain in Borgou cattle.

The effect of calving number is probably due to a better maternal environment provided by older cows, such as a higher milk production (Hoste et al., 1983; Dehoux, 1993).

Effect of sex

Male calves were heavier ($p<0.01$) than female for BW and WW, but not for cumulative average daily gain (Table 1). Similar sex effect have been reported on other cattle breeds: Boran (Kassa-Mersha and Arnason, 1986); N'Dama (Planchenault et al., 1986, Poivey et al., 1987); beef cattle (Ahunu and Makarechian, 1987); Gudali and Wakwa (Abassa et al., 1993); Gudali and synthetic breeds (Tawah et al., 1993; Ebangi et al., 2002a); Nguni (Kars et al., 1994); Borgou (Youssao et al., 2000) and Zebu azawak (Boly et al., 2000). The advantage of males over females may be attributed to hormonal differences in their endocrinological and physiological functions. However, Thorpe et al. (1980), Lubout (1987), Njoya et al. (1998) and Tawah et al. (1993) did not find any sex effects.

Table 2. Comparative growth performance of West and Central African cattle breeds.

Breed	Birth weight (kg)	Pre and post weaning weight (kg)	Age {days (months)}	Authors
Shorthorn cattle				
	24.4±7.95 (n = 8)	42.6±4.5 (n = 22)	90 days (3 months)	
		57.5±2.1 (n = 96)	180 days (6 months)	
Baoulé		65.2±1.7 (n = 189)	270 days (9 months)	Poivey et al. (1987)
		80.1±1.8 (n = 165)	360 days (12 months)	
		101.8±1.8 (n = 131)	540 days (18 months)	
		117.2±2.9 (n = 75)	720 days (24 months)	
		198.2±10.8 (n = 22)	1032 days (34.4 months)	Hoste and Cloe (1982)
N'dama		36.1±5.6 (n = 12)	90 days (3 months)	
		58.8±3.4 (n = 36)	180 days (6 months)	
		73.1±2.3 (n = 90)	270 days (6 months)	Poivey et al. (1987)
		86.9±2.5 (n = 62)	360 days (12 months)	
		118.9±2.7 (n = 63)	540 days (18 months)	
		134.9±2.9 (n = 67)	720 days (24 months)	
		175.9±11.2 (n = 22)	975 days (32.5 months)	Hoste and Cloe (1982)
Namchi	13.23±0.30 (n = 80)	42.87±1.07 (n = 80)	90 days (3 months)	
		68.34±1.22 (n = 80)	180 days (6 months)	Ebangi et al. (2002a)
		85.86±1.76 (n = 80)	270 days (9 months)	
		104.73±1.36 (n = 80)	360 days (12 months)	
Kapsiki or Firdi	15.46±0.36 (n = 83)	57.99±1.27 (n = 83)	90 days (3 months)	
		75.19±1.42 (n = 83)	180 days (6 months)	
		97.56±2.23 (n = 83)	270 days (9 months)	Ebangi et al. (2002a)
		115.46±1.49 (n = 83)	360 days (12 months)	
Méré		210.7±10.2 (n = 27)	975 days (32.5 months)	Hoste and Cloe (1982)
Borgou	18.86±1.87 (n = 451)	41.12±8.6 (n = 440)	90 days (3 months)	Youssao et al. (2000)
		102.21±23.41 (n = 391)	360 days (12 months)	
Lagune	10 - 12	96.0 (n = 53)	720-1080 days (24-36 months)	Adeniji (1985)
		111.0 (n = 120)	1080-1440 days (36-48months)	Domingo (1976)
		157.0 (n = 130)	>1440 days (>48 months)	Agbemelo (1983)

Table 2. Contd.

Lagune	9.5 - 10.0	83.0 - 87.0	360 days (12 months)	Lazic (1978)
Zebus				
Zebu Akou	23.2±1.22 (n = 39)	118.3±5.30 (n = 28)	270 days (6 months)	Njoya et al. (1998)
		136.7±6.90 (n = 17)	360 days (12 months)	
Zebu Arabe (Choe)	21.9±1.89 (n = 17)	102.1±8.56 (n = 8)	270 days (6 months)	
		110.1±12.60 (n = 4)	360 days (12 months)	
Goudali	24.0±1.39 (n = 24)	117.2±4.67 (n = 34)	270 days (6 months)	
		135.6±6.06 (n = 22)	360 days (12 months)	
Mbororo	22.4±1.81 (n = 19)	115.0±3.28 (n = 9)	270 days (6 months)	
		141.4±11.03 (n = 5)	360 days (12 months)	
Goudali	24.09±2.73 (n = 2886)	149.79±28.49 (n = 2899)	240 days (8 months)	Ebangui et al. (2002b)
Wakwa	24.90±3.14 (n = 1793)	161.65±29.54 (n = 1878)	240 days (8 months)	
Zébu		182.9±8.8 (n = 1878)	912 days (30.4 months)	Hoste and Cloe (1982)
Zébu azawak	19.5 - 24.1	80.0 - 108	180 days (6 months)	Chartier et al. (1982)
		129.0 - 178	360 days (12 months)	
		187.0 - 280	720 days (24 months)	
		250.0 - 352	1080 days (36 months)	

Effect of age at weaning

The effect of age at weaning (WAGE) as a covariate, was quite sensitive ($p < 0.01$) for ADG. This might indicate that calves with heavier birth weights tended to maintain this superiority for daily gain until weaning. Similar result has been reported by Ebangi et al. (2002a).

Conclusion

Despite of their rusticity, adaptability to local environmental conditions and trypanotolerant characteristic, the Lagune cattle has been poorly used for meat production in Benin. Such carelessness was responsible of limited knowledge on it growth potential. Consequently, the data from the present work bring out some useful information for the breeding of Lagune cattle. Considering the fixed factor effect in this study, it will be possible to exert more control on Lagune growth.

For meat production, males can be slaughtered earlier than females, as they have higher BW and WW than female. The use of higher parity cow would be suitable to improve the BW and WW and then directly increase the meat production. Improvement of management and breeding conditions over the year could be more interesting to improve the growth rate.

For the sustainable use of Lagune cattle breed, more basics knowledge of the growth need to be accumulated as well as the study of the post weaning growth, in order to identify the features that are likely to affect them, such as, sex, birth season and year, and mother's age, thus assuring that adjustments on the growth rate can be achieved, allowing the animal scientists and the livestock office of Benin, to be more able to identify animals with superior genetic potential for growth.

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