Journal of Advanced Veterinary and Animal Research
ISSN 2311-7710 (Electronic)
http://doi.org/10.5455/javar.2018.e255
A periodical of the Network for the Veterinarians of Bangladesh (BDvetNET)

June 2018
Vol 5 No 2, Pages 123-130.

Original Article

Zootechnical performance of Girolando cattle at Kpinnou Breeding Farm, South-West of Benin Republic

Yacoubou Alassane[1], Serge Gbênagnon Ahounou[1], Soumanou Seibou Toleba[2], Achille Amour Adjakpa[1], Ignace Ogoudanan Dotche[1], Isidore Houaga[1], Nassim Moula[3], Nicolas Antoine-Moussiaux[3], Jean-Luc Hornick[3] and Abdou Karim Issaka Youssao[1,*]

• **Received:** July 12, 2017 • **Revised:** Sep 7, 2017 • **Accepted:** Oct 12, 2017 • **Published Online:** May 3, 2018

AFFILIATIONS

[1]*Laboratory of Animal Biotechnology and Meat Technologies, Department of Animal Health and Production, Polytechnic School of Abomey-Calavi, University of Abomey-Calavi 01 PO Box 2009, Cotonou, Republic of Benin.*

[2]*Department of Animal Production, Faculty of Agronomic Sciences, University of Abomey-Calavi 01 BP 526, Cotonou, Republic of Benin.*

[3]*Department of Veterinary Management of Animal Resources/ Faculty of Veterinary Medicine / University of Liège, 6 avenue de Cureghem, 4000 Liège , Belgium.*

CORRESPONDENCE:

 # Issaka Youssao Abdou Karim, *Department of Animal Health and Production, Polytechnic School of Abomey-Calavi, University of Abomey-Calavi 01 PO Box 2009, Cotonou, Benin Republic. E-mail: iyoussao@yahoo.fr*

ABSTRACT

Objective: The aim of the study was to assess the weight and reproductive performances of Girolando cattle at Kpinnou Breeding Farm (KBF) in the south western of Benin Republic.

Materials and methods: The weight performance and body measurements were taken on a total of 150 Girolando cattle. The study of the reproductive traits was based on the recorded demographic indicators between 2012-2013 of 67 cows.

Results: From calving to the age of 3 months, the monthly average weight of calves did not vary with the season of calving ($P>0.05$). Between the 4th and 9th month, the weight varied with the birth seasons and the sex of the calf. Beyond 9th month, the calf's average weight was the same regardless the calving season. At the age of 24 months, the highest weight (393.33 kg) was obtained during the long rainy season. The highest average weight was 398.22 Kg for males against 364.25 Kg for females at 24 months. The fertility rates ranged from 91.18% to 100% and the fecundity rate ranged from 85.29% to 103% during the study period. The apparent fertility rate was 91.18%. As for the calving and abortion rates, they were 93.55% and 6.45%, respectively. The mortality rate before weaning was 6.90% while the weaning viability was 93.10%. Calving occurred from January to June and from August to December.

Conclusion: In overall, the Girolando performances are satisfactory and show a good adaptation at KBF.

KEYWORDS

Benin; weight; Bovine; Calving Season; Maturity Rate; Reproductive performance

How to cite: Alassane Y, Ahounou SG, Toleba SS, Adjakpa AA, Dotche IO, Houaga I, Moula N, Antoine-Moussiaux N, Hornick JL, Youssao AKI. Zootechnical performance of Girolando cattle at Kpinnou Breeding Farm, South-West of Benin Republic. Journal of Advanced Veterinary and Animal Research. 2018; 5(2):123-130.

INTRODUCTION

Livestock production in sub-Saharan Africa plays a key role in food security and the fight against poverty (Kouamo et al., 2014). Despite the importance of the livestock sector in these countries, animal protein requirements are not being covered. This inability to meet demand is due to the low productivity of animals (Adjou Moumouni, 2006). Apart from the poor performance of the animals, the pathologies, which are very frequent in this area, have a negative impact on the productivity of the animals. In Benin, the deficit in animal protein led to a significant increase in imports. The quantity of imported meat and offal increased from 56,754 in 2000 to 192,979 tons in 2012 and for dairy products it rose from 9,152 in 2000 to 11,929 tons in 2012 (FAOSTAT, 2015). To address this situation, several livestock development programs have been implemented to improve productivity. This is the Livestock Development Project (PDE), which had undergone three phases (I, II and III) and the Milk and Meat Support Project (PAFILAV). As part of the implementation of PDE Phase III, Girolando cattle were imported from Brazil to the Kpinnou breeding farm in November 2004 (Hestin, 2012).

After a 5-year adaptation period in its new biotope, the zootechnical performance of the breed was below the average of the same breed in its country of origin (Toukourou and Senou, 2010; Alkoiret et al., 2011; Doko et al., 2012). However, these first evaluations did not take into consideration the effects of different environmental factors, the most important of which is the calving season. The growth curve parameters, evolution of the body weight by sex and the morphometric measurements of this breed were not evaluated as well as most of the reproductive traits. From a health point of view, the dominant pathologies of the Girolando have been inventoried and an adequate prophylaxis plan has been proposed so that the animals can better optimize their zootechnical performance (Megan, 2014).

The general objective of this study was to assess the level of adaptation of this breed through its reproductive and production performances at the Kpinnou Breeding Farm. Specifically, it evaluated (1) effect of the calving season and sex on its weight performance and growth curve parameters, (2) morphometric measurements of this breed for its characterization in the new biotope, and (3) breeding performance in its adaptation phase at Kpinnou breeding farm.

MATERIALS AND METHODS

Study area and characteristics of the farm: The study was conducted at the Kpinnou Breeding Farm (**Figure 1**). The geographical location, average annual temperature, climate and rainfall of this farm were described by Kassa et al. (2016). The rearing facilities used, the mode of feeding, the mode of reproduction, the sanitary and medical prophylaxis applied on the farm were also described by Kassa et al. (2016).

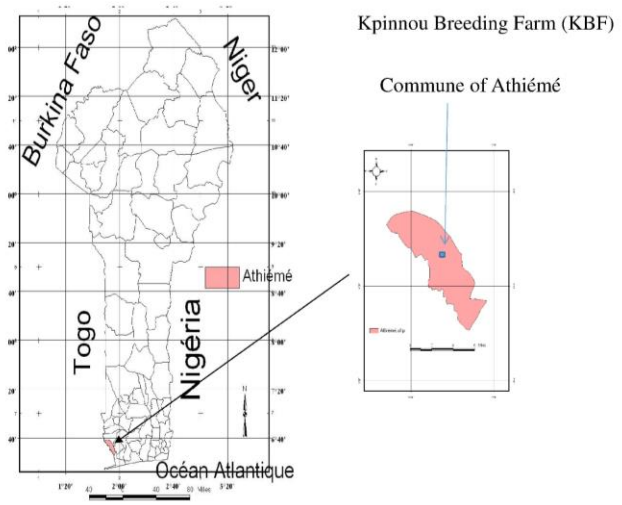

Figure 1. Map localizing Kpinnou Breeding Farm (Kassa et al., 2016).

Data collection: The data collection covered the period from 2004 to 2010. The weight performance and body measurements were taken on a total of 150 Girolando cattle. The animals were weighed from birth at day D0 and then monthly until 28 months of age according to sex and season. Skeletal muscle development and developmental traits were measured. For the muscular development, the body measures taken into account were:

- *the roundness of the pants: between the tip of the buttocks and the tip of the hock;*
- *panty width: distance between the 2 furrows of each thigh, halfway up the pants;*
- *thickness of the top: taken at the level of the transverse apophyses of the lumbar vertebrae at the hollow of the flank;*
- *top of the shoulder: distance between the two shoulder blades.*

As for the skeletal development, the body measurements taken were:

- *cannon size: the diameter at mid-length of the anterior guns;*
- *length of the top: distance between the front and back legs;*
- *top of the shoulder: distance between the two shoulder blades;*
- *pelvis length: distance between the two verticals passing through the hip point and the buttocks respectively;*

- *back width: distance between the two lateral lines at mid-length of the spine;*
- *withers height: it was measured by a rod, held vertically next to an anterior limb of the animal and on his withers just behind the hump;*
- *thoracic perimeter: it was taken behind the shoulders and just behind the tip of the elbow on the animal breathing out;*
- *scapular-ischial length: distance between the tip of the elbow and the tip of the ischium.*

The study of the reproductive traits was based on the recorded demographic indicators between 2012-2013 of 67 cows. These reproductive parameters are calculated as follows:

- *apparent fertility rate = number of pregnant females / number of reproductive females;*
- *abortion rate = number of aborted females / number of reproductive females;*
- *single farrowing rate = number of single farrowing / number of farrowing;*
- *twinning rate = number of twin farrowing / number of farrowing;*
- *prolificacy rate = total products born / number of farrowing;*
- *fecundity rate = number of products born alive / number of reproductive females;*
- *birth rate = total products born / number of reproductive females;*
- *stillbirth rate = number of deaths born / number of products born;*
- *perinatal mortality rate = number of deaths born + deaths from 0 to day x / number of products born;*
- *mortality rate before weaning = total deaths before weaning / number of products born alive;*
- *weaning viability rate = number of alive at weaning / number of live babies;*
- *mortality rate = number of dead products / number of products Average born;*
- *exploitation rate: Number of animals released (sale, donations) / Average size of the herd;*
- *numerical productivity of the herd = number of weaned products per year / number of reproductive females.*

Data analysis: The SAS software (SAS, 2006) was used for statistical analysis. The Proc means procedure was used to calculate the means of morphometric parameters. The analysis of variance was carried out by the Generalized Linear Models (GLM) procedure with the calving season and sex of animal as factors of variation. The means were compared in pairs by the Student test (t). The Gompertz equation was used to describe growth performance. The parameters of the growth curve were calculated according to this equation:

$Y=\alpha \times \exp(-\beta \times \exp(-\gamma \times t))$, where Y is the weight of the bovine (kg); α is the asymptotic weight; β is the integration constant; γ is the growth rate factor (maturation factor) and t is the time (Porter et al., 2010). These parameters (α, β, γ) were estimated by nonlinear regression using the Marquard method in the nonlinear models of the SAS procedure (SAS, 2006). The age of inflection, corresponding to the period of maximum growth, was calculated according to the following formula: $Ti = (1/\gamma) \times |\beta| \ln$ (Porter et al., 2010).

RESUTS

Evolution of weight performance by season

In general, the average monthly weights of Girolando calves increased with the age regardless the season. From birth to three months of age, the average monthly weight of calves did not vary significantly with the seasons. At birth this weight was 26.42; 27.56; 26.53 and 20.50 Kg for the long rainy season, the short rainy season, the long dry season and the small dry season, respectively (**Table 1**).

After 3 months, a significant variation of the monthly weight with season was observed between 4th and 9th

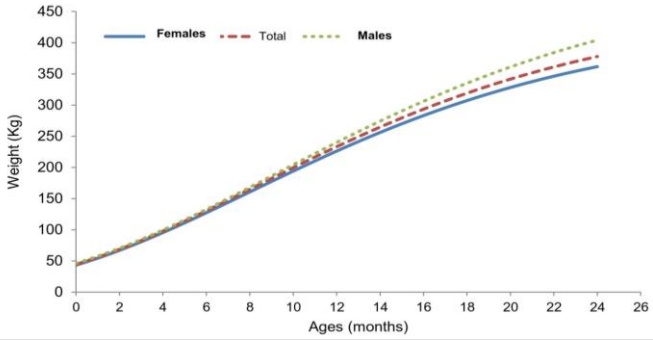

Figure 2. Modeled growth curves of Girolando cattle in semi-intensive breeding system at KBF.

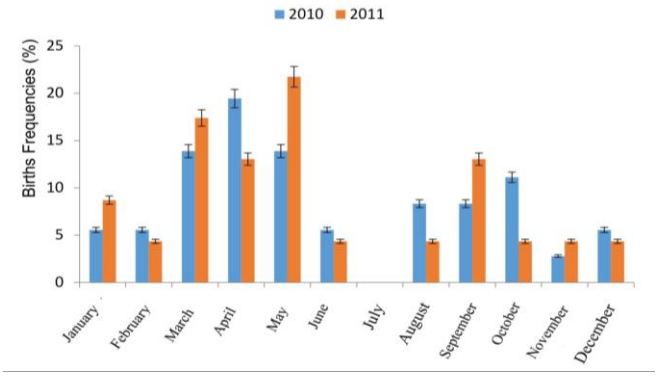

Figure 3. Distribution of births in Girolando cattle at the Kpinnou Breeding Farm.

Table 1. Evolution of weight performance by calving season

Variables	LRS			SRS			LDS			SDS			Signif-icance
	N	Mean (kg)	SE	N	Mean (kg)	SE	N	Mean (kg)	SE	N	Mean (kg)	SE	
W0	43	26.42^{a}	0.91	18	27.56^{a}	1.41	83	26.53^{a}	0.66	6	20.50^{a}	2.44	NS
W1	0	-	-	-	-	-	9	46.44	3.34	0	-	-	-
W2	7	64.00^{a}	4.44	-	-	-	24	66.63^{a}	2.40	3	62.00^{a}	6.78	NS
W3	19	83.79^{a}	3.93	1	66.00^{a}	17.12	52	86.21^{a}	2.37	3	79.67^{a}	9.88	NS
W4	25	97.12^{b}	3.53	6	96.17^{bc}	7.20	67	108.33^{a}	2.15	3	84.00^{c}	10.18	**
W5	27	113.74^{c}	4.19	12	116.50^{bc}	6.29	65	127.17^{a}	2.70	3	124.33^{ab}	12.58	*
W6	28	129.96^{c}	1.41	12	139.08^{b}	6.74	60	145.97^{a}	3.01	4	139.00^{b}	11.67	*
W7	24	137.96^{c}	4.67	12	158.25^{b}	6.60	56	163.66^{a}	3.05	4	157.50^{b}	11.44	***
W8	27	153.59^{c}	4.69	12	173.42^{b}	7.04	58	177.64^{a}	3.20	5	173.40^{b}	10.90	***
W9	28	169.61^{c}	4.53	12	187.42^{b}	6.92	54	190.35^{a}	3.26	4	190.00^{ab}	11.99	**
W10	26	190.54^{a}	5.15	11	204.82^{a}	7.92	57	201.77^{a}	3.48	3	201.33^{a}	15.17	NS
W11	26	199.54^{a}	5.68	8	224.88^{a}	10.24	57	213.77^{a}	3.84	3	208.33^{a}	16.72	NS
W12	23	209.83^{a}	7.31	16	209.19^{a}	8.76	58	227.52^{a}	4.60	3	228.00^{a}	20.23	NS

Legend: LRS = Long Rainy Season, SRS = Short Rainy Season, LDS = Long Dry Season, SDS = Short Dry Season, NS = Not significant, * : $P<0.05$, ** : $P<0.01$; *** : $P<0.001$; Wi = Weight at month i, SE = Standard Error. Means with same superscript on the same row did not differ significantly ($P>0.05$); N: Number per category.

Table 2. Weight performance of Girolando cattle by sex

Variables	Female			Male			Significance
	N	Mean (kg)	SE	N	Mean (kg)	SE	
W0	74	25.96	0.70	76	26.79	0.69	NS
W1	3	57.00	3.78	6	41.17	2.67	*
W2	14	71.14	2.85	20	61.85	2.39	*
W3	41	83.29	2.65	34	87.21	2.91	NS
W4	51	102.71	2.59	50	105.54	2.62	NS
W5	54	118.22	3.00	53	126.87	3.02	*
W6	52	135.77	24.61	52	145.42	22.64	*
W7	49	152.04	26.50	47	160.74	22.72	NS
W8	50	165.88	28.12	52	175.08	23.52	NS
W9	49	181.00	25.23	49	187.10	25.35	NS
W10	48	195.73	25.47	49	202.39	27.14	NS
W11	47	206.77	29.36	47	214.45	29.44	NS
W12	48	213.85	32.14	52	226.69	37.40	NS
W13	41	235.46	5.50	48	238.83	5.08	NS
W14	35	253.09	34.85	32	265.25	35.77	NS
W15	34	272.82	35.38	25	288.04	39.58	NS
W16	29	287.86	34.73	18	306.78	45.25	NS
W17	28	301.64	36.89	18	324.50	43.51	NS
W18	22	313.64	39.59	17	342.88	46.93	*
W19	22	321.36	39.12	17	357.18	49.07	*
W20	22	324.91	41.40	17	366.65	47.92	**
W21	23	342.61	44.49	15	378.73	50.46	*
W22	23	349.09	46.28	15	384.87	51.48	*
W23	19	362.37	48.06	13	401.77	47.50	*
W24	12	364.25	50.34	9	398.22	42.33	NS
W25	8	373.00	41.54	6	413.50	35.64	NS
W26	7	391.43	28.79	3	418.00	37.75	NS
W27	3	395.00	19.09		-	-	-
W28	3	406.06	25.01		-	-	-

NS= $P>0.05$, *: $P<0.05$, **: $P<0.01$, Wi = Weight at month i, SE=Standard Error, N=Number per category

months in Girolando cattle raised at the Kpinnou Breeding Farm (**Table 1**). For this age group, calves born during the long dry season had a higher weight performance than calves born during other seasons of the year ($P<0.05$). At 9 months of age, calves born during the long rainy season had the lowest weights while the calves born during the short dry season had a weight similar to those of calves born during the short rainy season. Beyond the 9th month, the average calf weight was identical regardless the calving season. At 12 months of age, Girolando had an average weight between 209 to 228 Kg (**Table 1**).

Table 3. Morphometric measurements of Girolando cows at KBF

Variables	Mean (cm)	SD	Coefficient of variation (%)
Panty width	27.6	4.72	17.11
Thickness of the top	5.4	0.55	10.14
Length of the top	68.8	4.66	6.77
Pelvis width	49.8	1.92	3.86
Back width	35.6	2.19	6.15
width at the hips	47	4.12	8.77
Withers height	127	4.36	3.43
Thoracic perimeter	175.4	10.01	5.71
scapular-ischial length	122.1	7.07	5.79
width at the trochanters	56.6	2.70	4.77
Ear length	27.2	3.83	14.10
Horns length	22	4.24	19.28
Distance between horns	18.5	2.65	14.30
Rounding of the muzzle	46.5	3.54	7.60
Tail length	84.4	7.89	9.35

SD: Standard deviation

Table 4. Demographic indicators of Girolando cattle at the Kpinnou Breeding Farm

Variables	2012	2013
Apparent fertility rate (%)	100	91.18
Abortion rate (%)	3.03	6.45
Birth rate (%)	96.97	93.55
Prolificacy rate (%)	100	100
Fecundity rate (%)	103.03	85.29
Birth rate (%)	90.91	85.29
Mortality rate before weaning (%)	0.00	6.90
Adult mortality (%)	-	2.03
Weaning viability rate (%)	100	93.10
Total released (Head)	17	42
Average number (Head)	101.5	98.5
Exploitation rate (%)	16.75	42.64
Numerical Growth (%)	10.84	-17.26
Numerical yield (%)	27.59	25.38

Evolution of weight performance by sex

At birth, the average weight of male calves (26.79 Kg) was identical to that of females (25.96 Kg). At 2 and 3 months of age, female weights were higher ($P<0.05$) than males. Beyond the 3rd month, the average weight at a specific age of males was higher than that of females but did not show a significant difference at certain periods of the growth (**Table 2**). The significant differences between the monthly weights of males and females were obtained from the 5th to 6th month and from the 18th to 23rd month of age (**Table 2**). The weights of Girolando cattle at 12-month and 24-month were 213.85kg and 364.25 Kg for heifers and 226.69 Kg and 398.22 Kg for bull calves, respectively.

Growth curve for Girolando cattle

The evolution of the growth curve over time in Girolando cattle showed that the asymptotic weight of the males was higher than that of the females (**Figure 2**). The maturation rate (γ) was 0.0032 and 0.0035 per day for males and females, respectively. The inflection point was 9.16 months for males against 7.97 months for females.

Body measurements of Girolando cattle

The panty width and top thickness were 27.6 cm and 5.4 cm respectively, with coefficients of variation of 17.11% and 10.14%, respectively for the Girolando. As to the length of the top, pelvis width, back width, width at the hips, the thoracic perimeter, and the width at the trochanters, their measurements were 68.8; 49.8; 35.6; 47; 175.4 and 56.6 cm, respectively. The height at the withers of the Girolando was 127 cm and the length of the horns and the tail were 122.1 cm and 84.4 cm, respectively (**Table 3**). Considering adult weight and body measurements, the Girolando breed is hypermetric and slender.

Reproductive performance

In 2012, 32 births were recorded at Kpinnou Breeding Farm, of which 2 were double out of a total of 33 females mated (**Table 4**). The fertility rate was 100% and the fecundity rate was 103% (**Table 4**). The number of calves born was 34. No mortality of calves was recorded before weaning. During the year, three cases of cow's mortalities were recorded. In 2013, the farm had a total of 107 cattle. During the year, 29 births were recorded against four deaths. The apparent fertility rate was 91.18% and the fecundity rate was 85.29%. The calving rate was 93.55% and the abortion rate was 6.45% for 31 pregnant females. The births observed were single births and 6.90% mortality was recorded before weaning resulting in a weaning rate of 93.10%. Calving occurred from January to June and from August to December. The largest number of births was recorded from March to May (**Figure 3**).

DISCUSSION

Evolution of weight performance by season

The average monthly weights of Girolando calves increased with age regardless of the season. From birth to three months of age, the average monthly weight of calves did not vary significantly with the seasons. The absence of the seasonal effect can be explained on the one hand by the fact that the calves were exclusively fed on breast milk during this period. Since the Kpinnou

Farm is not a for-profit farm, competition between calf and man is not observed for milk intake. On the other hand, the Girolando are raised in an agro-ecological zone characterized by two dry seasons and two rainy seasons. During the dry season, forages become scarce and their nutritive values decrease, causing a reduction in forage availability. This deficiency in quality fodder is often compensated by the addition of food supplements to ensure better production and good breastfeeding of calves. In agro-ecological zones characterized by one dry season and one rainy season, the duration of each of the two seasons negatively or positively influences the milk production of the cows. This is the case of the Okpara Breeding Farm, where milk production is influenced by the season, with the consequence of a seasonal effect on the growth of calves from birth to weaning (Youssao et al., 2000a). At the Okpara Breeding Farm, the highest birth weights are obtained in calves born in the rainy season. At birth, the mean weights (20 to 27 kg) obtained in the Girolando are similar to those (26 to 30kg) obtained by Toukourou and Senou (2010) on the same animals at the Kpinnou Breeding Farm. These weights in general are higher than the birth weights of local breeds in Benin (Youssao et al., 2009; Ouorou Biningui, 2012). On the other hand, the highest average birth weight in the Girolando is lower than that reported in the agro-pastoral farm of Pout in Senegal (Byishimo, 2012).

The season effect was observed on the weight of the Girolando between the 4th and the 9th month of age in our study. At 9 months of age, calves born during the long rainy season had the lowest weights while calves born during the long dry season showed the highest weight performance compared the calves born during other seasons of the year. This result is explained by the fact that animals born during the dry season feed exclusively on breast milk during this season, which lasts an average of 4 months. Beyond the 4th month, these calves benefit first from the young regrowth of Panicum maximum C1 (tender fodder very appreciated by the calves) and then of the abundance of the grazing during the whole rainy season. Conversely, calves born during the rainy season go through the entire dry season with all the difficulties related to feeding during this season. Our results are similar to those obtained in extensive livestock farming in Uganda where the calves born during the dry season were higher than calves born in the rainy season whose cows went through the dry season (Lagu et al., 2012). On the other hand, a seasonal effect was observed in four-month-old Friesian and Ankolian calves raised in a station where the cows benefited from a dietary intake (Lagu et al., 2012). Indeed, these authors reported that during the first four months of life, the highest weights are obtained during the wet season at the station.

Beyond 9th month, the average weight of calves was identical regardless of the season of birth. This implies compensatory growth which is related to the fact that weaned animals undergo the same treatments and that the animals in phase of growth retardation, physiologically, develop a high compensatory growth. Contrary results were obtained in the Afyon province of Turkey where steers raised in the cold season performed less than those of the dry season despite being fed under the same conditions (Demircan et al., 2007).

At the age of 12 months, the Girolando had an average weight ranging from 209 to 228 kg. This weight is similar to that obtained by Toukourou and Senou (2010) on the same cattle breed. On the other hand, this weight is higher than that of the local breeds in particular the Borgou breed under selection or not (Youssao et al., 2009) and N'dama (Akouango et al., 2010).

Evolution of growth performance by sex

The growth performance of Girolando cattle varied according to the sex of the animal although a significant difference was not observed at birth. The female calves showed the highest weights over males between 2 and 3 months. Similar results were obtained in the Friesian and Ankole calves in Uganda (Lagu et al., 2012). Significant differences between the monthly weights of males and females were also obtained from the 6th month and the 18th to the 23rd month of age. This could be explained by the early growth in females compared to males. This observation is related to the fact that females, from a genetic point of view, have rapid growth and early maturity than males. Our results are similar to those obtained by Ouedraogo (2013) on the zebu peulh, Azawak and the Azawak crossbreeds for the ages of 1 to 2 months and 4 to 6 months, respectively.

Growth curve parameters for Girolando cattle

The modeled growth curve of Girolando cattle showed that the asymptomatic weight of males is higher than that of females. This result is contrary to that obtained by Youssao et al. (2013) in Borgou breed in a semi-intensive system. The rate of maturation (γ) and age at inflection point are similar between sexes and similar to the result obtained by Youssao et al. (2013) in Borgou cattle. Moreover, the age at the inflection point of the Girolando is very short (**Table 3**) compared to that of

the Borgou breed (22.9 months for males against 23.4 for females). This difference is related to the genetic background: Girolando cattle are an improved breed that is fast growing and genetically different from the Borgou breed, which is a local, slow growing breed. This age indicates when the animals reached maximum growth (Théwis et al., 2005). It is the ideal age where the cost / growth ratio is optimal and where it is advisable to remove the animals for fattening because the animal consumes more than it produces.

Reproductive Performances

The fertility rate of Girolando cattle varied from year to year. It was 100% in 2012 against 91.18% in 2013. The fecundity rate obtained in 2012 (103%) is higher than in 2013 (85.29%). The superiority observed in 2012 is related to the fact that 2 cases of twin calving were recorded during the period. The fecundity rate obtained is higher than that of the Borgou breeds in the station. According to Youssao et al. (2000b) and Adjou Moumouni (2006), the fecundity rate of Borgou cows were 81.55% from 2003 to 2005 and 78% from 1994 to 1997, respectively. Abortion and mortality rates increased from 2012 to 2013, which is due to the effects of parasitic diseases in general and especially trypanosomiasis observed at Kpinnou Breeding Farm (Megan, 2014).

Periods of births are from January to June and from August to December in the Girolando cow. From this distribution, season and food availability influence the reproductive cycle of Girolando cows in southern Benin. The calving period from January to June corresponds to that of cows in gestation during the long rainy season and that from August to December corresponds to cows in gestation during the long dry season. Farrowing is low because of the inadequacy and nutritional quality of fodder resources (Yaokorin, 2007; Meyer, 2009). Feed supplementation, reproduction control and selection can positively influence farrowing (Yaokorin, 2007; Akouango et al., 2010), taking into account the conditions of rearing at the Kpinnou Breeding Farm, the animals benefit from concentrates during the lean periods. The observed effect may be related to the individual characteristics of the cows.

CONCLUSION

The evaluation of the zootechnical performances of the Girolando cattle at the Kpinnou breeding farm reveals that these performances vary according to calving seasons and the calves born during the long dry season have the best weight performances during the growth phase. The weight of male calves is higher than that of females and this difference increases with age. The Girolando breed has a hypermetric format and a slender proportion. The season influences calving frequencies and birth periods are from January to June and from August to December. In overall, the performances obtained are satisfactory compared to the results of previous studies on the same animals and showed a good adaptation of the Girolando breed to the rearing conditions of the Kpinnou Farm. However, improvement is still possible because optimal performance is not yet achieved.

ACKNOWLEDGEMENT

The authors would like to thank Milk and Meat Support Project (PAFILAV) and the Project on Livestock Development (Phase III) of Directorate of Livestock (Benin) for their financial contribution and for the availability of the database.

CONFLICT OF INTEREST

The authors declare that there is no conflicting interest with regards to the publication of this manuscript.

AUTHORS' CONTRIBUTION

YA collected the data in register and wrote the manuscript. SGA, SST, AA collected the animal data. IOD and NM did the statistical analysis and IH translated in English and read the document. Finally, NAM, JLH and AKIY validated the protocol, certified the statistical analysis and supervised the manuscript writing and reading.

REFERENCES

1. Adjou Moumouni PF. Evaluation des performances zootechniques des bovins de race Borgou en sélection a la ferme de l'Okpara- Bénin. Thèse Médecine Vétérinaire, Dakar, Universté Cheik Anta Diop, Sénégal. 2006.
2. Akouango F, Ngokaka C, Ewomango P, Kimbembe E. Caractérisation morphométrique et reproductive des taureaux et vaches N'Dama du Congo. Animal Genetic Resources. 2010; 46:41–47. https://doi.org/10.1017/S2078633610000688.
3. Alkoiret I, Mama Yari H, Gbangboche B, Lokossou R. Reproduction performance and milk production of Girolando cows in the ranch of Kpinnou, South-West of Benin Republic. Journal of Animal and Veterinary Advances. 2011; 10(19):2588–2592. https://doi.org/10.3923/javaa.2011.2588.2592

4. Byishimo J. Contribution à l'évaluation des performances de reproduction et de production des bovins Girolando dans la ferme agro-pastoral de Pout au Sénégal. Thèse de Médecine Vétérinaire, Dakar, Universté Cheik Anta Diop, Sénégal. 2012.
5. Demircan V, Koknaroglu H, Yilmaz H. Effect of season on Beef cattle performance and profitability. Agricultura Tropica et Subtropica. 2007; 40:19–24.
6. Doko AS, Gbéto Tossa I, Tobada P, Mama Yari H, Lokossou R, Tchobo A, Alkoiret TI. Performances de reproduction et de production laitière des bovins Girolando à la ferme d ' élevage de Kpinnou au sud-ouest du Bénin. Bulletin de la Recherche Agronomique du Bénin, Numéro spécial Elevage et faune. 2012; p. 35–47.
7. FAOSTAT. Banque de données statistiques. 2015. http://faostat3.fao.org/home/F, consulté le 15/07/2015. (Accessed on January 2018)
8. Hestin T. Les stratégies de developpement de l'élevage bovin au Bénin au travers de la mise en place de deux projets consécutifs: le PDE puis le PAFILAV. Thèse de Doctorat en Médecine Pharmacie, Université Claude-Bernard-Lyon, France. 2012.
9. Kassa SK, Salifou CFA, Dayo GK, Ahounou GS, Dotché OI, Issifou TM, Houaga I, Koutinhouin GB, Mensah GA, Yapi-Gnaoré V, Youssao AKI. Assessment of Milk Production and Resilience of Girolando Cattle, Reared in Semi-Improved Breeding System in Benin. Journal of Veterinay Advances. 2016; 6(6):1269-1281. https://doi.org/10.5455/jva.196912310400000000
10. Kouamo J, Dawaye SM, Zoli AP, Bah GS. Evaluation of bovine (Bos indicus) ovarian potential for in vitro embryo production in the Adamawa plateau (Cameroon). Open Veterinary Journal. 2014; 4:128–136.
11. Lagu C, Ayoo BL, Nabukenya I, Oluka J, Ntakyo P, Mutaka RN, Byenkya S. The Growth Performance Evaluation of Cattle Breeds in the South Western Agro-Ecological Zone (SWAEZ) of Uganda. A Bird's-Eye View of Veterinary Medicine. 2012; 17:322–336.
12. Megan A. Evaluation de la production du lait des vaches Girolando élevées dans le système d'élevage semi-amélioré à la Ferme d'Elevage de Kpinnou au Bénin. Mémoire de Master, Cotonou, Université Gasa-Formation, Bénin. 2014.
13. Meyer C. Les variations saisonnières de la reproduction des bovins domestiques en zone tropicale. Synthèse d'élevage et produits animaux, Cirad, France. 2009.
14. Ouedraogo A. Etude des performances laitieres des vaches zebus et de la croissance ponderale des veaux des noyaux de Ouagadougou et Komsilga. Thèse de fin de formation en Sciences et Techniques de Production Animale, Oudadougou Université de Oudadougou, Burkina Faso. 2013.
15. Ouorou Biningui ZK. Typologie des élevages traditionnels de bovin dans le Département de l'Alibori. Mémoire de fin de formation pour l'obtention du diplôme de Licence Professionnelle en Production et Santé Animales, Ecole Polytechnique d'Abomey-Calavi, Université d'Abomey-Calavi, Bénin. 2012.
16. Porter T, Kebreab E, Kuhi HD, Lopez S, Strathe AB, France J. Flexible alternatives to the Gompertz equation for describing growth with age in turkey hens. Poultry Science. 2010; 89:371–378. https://doi.org/10.3382/ps.2009-00141
17. SAS. User's guide (version 6, 4th Ed.), SAS. Inst. Inc., Cary, NC, USA. 2006.
18. Théwis A, Bourbouze A, Compère R. Manuel de zootechnie comparée Nord-Sud. Edition INRA. 2005; p. 1144–7605.
19. Toukourou Y, Senou M (2010). Performances zootechniques de la vache Girolando à la Ferme de Kpinnou au Bénin. Annales des Sciences Agronomiques, 14: 207–220.
20. Yaokorin YI. Influence de la période de mise bas sur la production laitière. Thèse d'Ingénieur Agronome, Lomé, Université de Lomé, Togo. 2007.
21. Youssao AKI, Ahissou A, Idrissou ND, Michaux C, Touré Z, Leroy LP. Facteurs non-génétiques influençant le poids et la croissance de veaux de race Borgou à la Ferme d'élevage de l'Okpara au Bénin. Revue d'élevge et de médecine vétérinaire des pays tropicaux. 2000a ; 53:285–292.
22. Youssao AKI, Ahissou A, Touré Z, Leroy PL. Productivité de la race Borgou à la ferme d'élevage de l'Okpara au Bénin. Revue d'élevge et de médecine vétérinaire des pays tropicaux. 2000b ; 53:67–74.
23. Youssao AKI, Dahouda M, Attakpa EY, Koutinhouin GB, Ahounou GS, Balogoun BS. Diversité; des systèmes d'é; levages de bovins de race bovine Borgou dans la zone soudanienne du Bénin. International Journal of Biological and Chemical Sciences. 2013; 7(1):125–146.
24. Youssao AKI, Koutinhouin GB, Kpodékon TM, Agnandjo H, Touré Z, Ahissou A. Influence d'une sélection phénotypique sur les perfomances de croissance et les caractères de développement musculaire et squelettique de jeunes bovins de races Borgou à la ferme d'élevage de l'Okpara (Bénin). Annales de Médecine Vétérinaire. 2009; 153:105–111.

****