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RESEARCH ARTICLE

COMPARATIVE STUDY OF THE REPRODUCTIVE PARAMETERS OF ANIMALS RESULTING FROM THE CROSS BETWEEN N'DAMA AND NELORE (N'DALORES) AND THE N'DAMA BREED AT KILA RANCH REPUBLIC OF CONGO

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ABSTRACT

The objective of this study was to compare the reproductive parameters of N'Dalores and N'Dama in order to measure the degree of blood supply from the N'Dalore breed to the N'Dama animals reared at the Kila ranch. 18 male and 32 female N'Dalores and 16 male and 28 female N'Dama were monitored from puberty to breeding. The data collected was analysed and processed using R software version 2. The comparison of the modalities of the variables studied by analysis of variance and the test of comparison of means were done by the Tukey test. The N'Dalores males reached puberty at the age of 542.13±3.2 days with a weight of 238.42±0.8 kg, while the N'Dama males reached puberty at 458.3±2.6 days with a weight of 168.7±8.2 kg. The scrotal circumference of the N'Dalores at puberty reached 25.6±9.3cm, the correlation between scrotal circumference and weight was positive ($r=0.64\pm 2.5$). In the N'Dama, the scrotal circumference reached 22.5 ± 1.5 cm, the correlation between scrotal circumference and weight was positive ($r=0.48\pm 0.6$). The age at first calving was 1407.08 ±51.43 days with a weight of 349.37±9.28 kg. The calving-to-calving interval was 537.32±6.52 days. The calving to fertility interval is 255.78±7.84 days, the fertilizing power is 0.71±5.17. The N'Dama females reached puberty at 472.47±1.41 days with a weight of 171.7±10 kg and calved at 1062±1.6 days with a weight of 217.6±4kg, while the calving-to-calving interval was 492.7±1.7 days and the fertilizing service interval was 172.2±0.4 days with a fertilizing capacity of 0.64±0.10. This study shows that Nelore blood supply improves the reproductive performance of N'Dama.

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INTRODUCTION

The Congo has an estimated cattle population of 37,098 head, 39.84% of which is owned by the modern sector and 60.16% by farmers (RGA MAE, 2017). There is a chronic shortage of meat products, hence the massive imports. In spite of enormous fodder resources, available land and an important hydrography, not to mention the average temperature which oscillates around 23°C with an annual rainfall of around 1200 mm, the production of meat products remains low (AKOUANGO, 2010). To satisfy the needs of the population in animal proteins, it requires the choice of animal species to be raised, especially since in Congo the dominant cattle breed in the majority of herds is the N'Dama. Despite its hardiness and trypanotolerance, it has slow growth, low meat yield, long calving intervals, low fertility and small scrotal circumference (DIMI, 2021). In order to improve the production and reproduction parameters of the local breed by the exotic breed, crossbreeding seems to be the ideal solution to increase

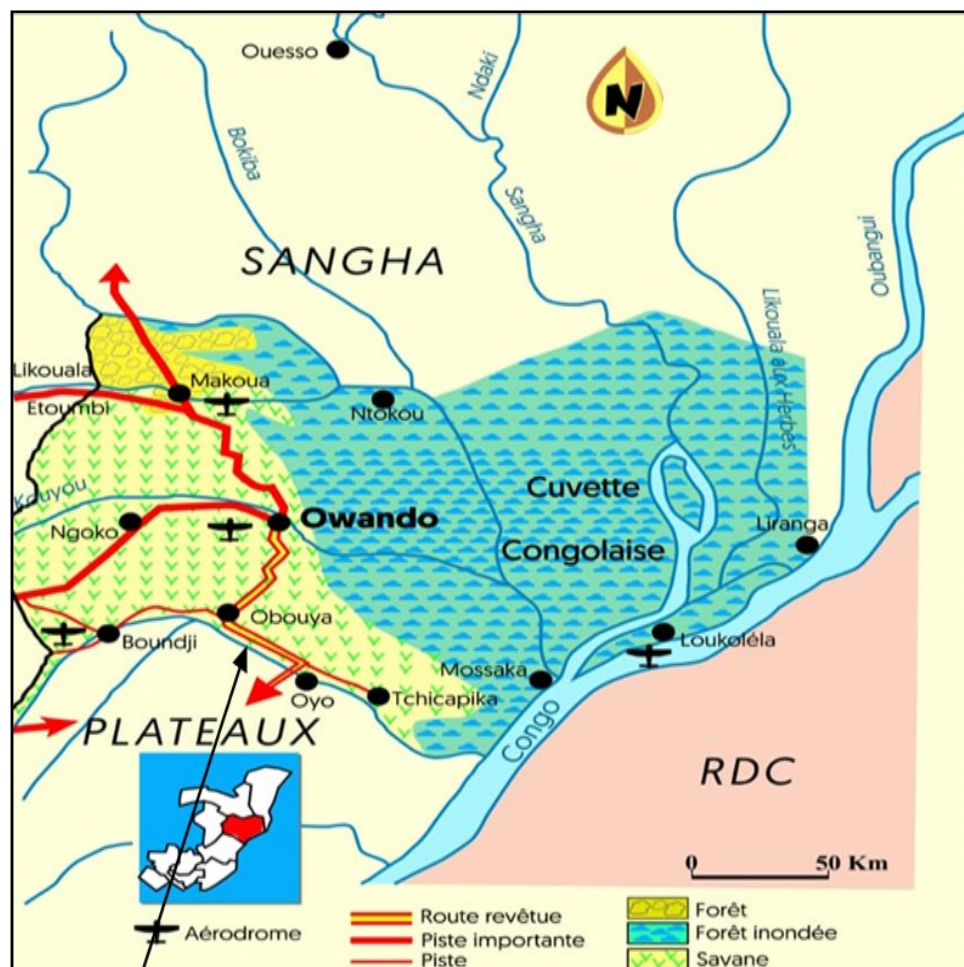
the productivity of the latter, because in these farms the known method of reproduction is natural free-mating. Therefore, the selection of the improving breed is crucial. Crossbreeding between two breeds allows to benefit from a favourable heterosis phenomenon on the characteristics that characterise reproduction, if the parent breeds are sufficiently homogeneous and different at the beginning to benefit from a good complementarity and if the crossed products are not placed in extreme environmental conditions (TAMBOURA et al, 1982). Thus, at the Kila ranch, the imported Nelore breed was well adapted and showed good reproductive performance. It was crossed with the local breed to produce crossbred animals called N'Dalores. These N'Dalores males and females were followed to breeding. In order to measure the degree of blood supply from the N'Dalore breed to the N'Dama animals, the reproductive parameters of the N'Dalores males and females were recorded and compared to those of the N'Dama. The objective of the present study is to compare the reproductive parameters of N'Dalores and N'Dama in order to measure the degree of blood supply from the N'Dalore breed to the N'Dama animals reared at the Kila ranch.

MATERIALS AND METHODS

Study environment: The present study was conducted in the department of the Cuvette located in the north-east of the Republic of Congo, specifically at the Kila ranch. The study took place between April 2017 and January 2021. The Kila ranch is located 15km from the sub-prefecture of Oyo in the north on the Oyo-Obouya axis, on national road no. 2 between the village of Bara and Opokagnia, in the Cuvette department. It is located south of the equator, between 1°11' 25.80" South latitude and 16°01' 56.11" East longitude of the Greenwich meridian at an altitude of 311m above sea level, in the south-west of the Congolese Cuvette. It specialises in the production and distribution of beef for the domestic market of the Republic of Congo. Figure 1 shows the location of the ranch on the map of the Cuvette department (DIMI al, 2020).

soil in the study area is characterised by almost permanent hydromorphy with an accumulation of organic matter. It is 86-96% sandy, rich in fine sand (62-73%), clay (0-8.5%) and very permeable. The pH varies between 5.2 and 5.9 (YOKA et al., 2007). Soil moisture also varies with depth.

Conduit of the live stock: The animals stay in the pastures where they spend the night, in the morning the herdsmen make the rounds of the pens to register births, deaths and sick animals. The animals graze on natural pastures, where species such as: *Bulbostylis laniceps*, *Trachypogon spicatus*, *Ctenium newtonii*, *Hyparrhenia wombaliensis* are found (MOPOUNDZA et al, 2016). The farm also has artificial grass pastures of: *Panicum massaye*, *Brachiara brizenta*, *Brachiara omidicola*, *Bracharia Lanciro*. Brewery grain is distributed twice a week with a vitaminised mineral supplement based on cooking salt. Drinking water is served ad libitum. The animals are regularly dewormed and treated with trypanocides. They are vaccinated against pasteurellosis and contagious bovine pleuropneumonia and are screened for brucellosis and tuberculosis. The mounts are natural, with breeding bulls left on them at all times.



Picture 1. Kila Ranch - Cuvette Department

Climate: The area is under the influence of the equatorial Congolese climate of the "Guinean Forest" type, characterised by a relatively high rainfall of 1600 -1800 mm of water per year, with an average annual temperature of 26°C and a low annual thermal difference of around 2°C. In this locality, the year is divided into four seasons: a major rainy season from October to December, a minor dry season from January to February, a minor rainy season from March to April and a major dry season from May to September (RMAE, 2012).

Hydrography, soil and vegetation: The study area is watered mainly on the eastern side by the Alima River, one of the tributaries of the Congo River, with an average flow of 537 m³/s (DIMI al, 2020). The

METHODS

The study herd consisted of the N'Dalores, 18 males and 32 females respectively, and the N'Dama, 16 males and 28 females respectively.

Determination of reproductive parameters

In bulls: Scrotal circumference in bulls, once the scrotal contents have been palpated, the testes are positioned firmly at the bottom of the bursa by applying a hand to the testicular cords. At the same time, it is important to avoid placing either finger between the testicles.



Picture 2. N'Dalore bull



Picture 3. N'Dalore cow



Picture 4. N'Dama bull



Picture 5. N'Dama cow

The pressure exerted should not be excessive to avoid abnormal spreading of the testicles. A tape measure is placed around the largest diameter of the testicles and clamped in such a way that it ensures simple contact with the scrotum. The height of the right and left testicle is taken with the tape measure held vertically between two thighs.

In cows: The Fertility Rate of the herd for each cow is calculated by the following formula:

$$F_i = \frac{365}{i}$$

F_i : fertility; i : average interval between two consecutive calvings.

From the F of each cow, the average F of the herd is calculated by statistical processing; i being the average interval between two consecutive calvings (AKOUANGO et al., 2010).

The results can have different natures:

If; $F_i < 1$, the cow could not give a calf during the year;
 $F_i = 1$, the cow was able to give a calf during the year;
 $F_i \geq 1$, the cow has given at least one calf during the year

Thus, for the 89 cows in the reproductive stage, the average could be calculated to determine the fertility of the herd.

$$PFT = \frac{\sum PF_i}{\text{Nombre des vaches}}$$

PFT: total fertility; $\sum PF_i$: sum of fertility

The calving-to-calving interval was determined by simply counting the days between calving. The calving to fertilisation interval was calculated by simply counting the days from the first calving to the day of fertilisation. Age and weight at first calving were determined by observation and weighing. The weight at puberty was determined by simple weighing after noting pubertal manifestations such as development of pelvic regions, provocation of males and threshold weight and its age. Determination of the sexual cycle was made possible by observing the periods of onset of heat by criteria such as mounting trial, immobilisation to males, lack of appetite, frequent mooing, presence of cervical mucus flowing from the vulva. The resumption of the postpartum cycle is recognised by the appearance of heat after parturition.

Statistical processing: The data were analysed using R software version 2.10.1.

Descriptive statistics of the variables studied: means, standard deviation, confidence interval, coefficient of variation.

The value of the probability was considered significant for a value ≤ 0.05 .

RESULTS

Reproductive parameters and testicular qualities of N'Dalores and N'Dama:

The testicular qualities of the N'Dalores are transcribed in Table 1. The age at puberty in N'Dalores bulls is reached between 16 and 18 months, with a weight of 238.42±0.8 kg. The height of the right testicle is 7.8±7.6 cm and that of the left testicle 8.9±4.1 cm. The scrotal circumference was 25.6±9.3 cm. The correlation between scrotal circumference and weight is 0.64±2.5.

Reproductive performance of N'Dalores and N'Dama cows:

The reproductive performance of N'Dalores cows is presented in Table 2. Considering the averages given on a population of 32 N'Dalores cows, the heifer starts puberty with a weight of 198.33±7.62 kg. At the adult stage, the age and weight at first calving are 1407.08±51.43 days and 349.37±9.28 kg respectively. The duration of the estrous cycle was 21.19±0.62 days, with a gestation period of 282.32±3.61 days.

shows that there is a testicular improvement. The correlation between scrotal circumference and weight is positive ($r=0.64$). This high positive correlation between scrotal circumference and body weight is important in the selection process. In N'Dalores females, age and weight at first calving were 1407.08±51.43 days and 349.37±9.28 kg respectively. Table 2 shows that, on average, the crossbreeding results in a gain of 26.63 kg at puberty and 131.17 kg in weight at first calving compared to the N'Dama, which proves that there is a crossbreeding effect in the sense of improvement. Indeed, the earlier a female is, the more calves she will produce during her breeding career. The N'Dama calves for the first time at 1062±1.6 days, 345.08 days earlier than the N'Dalore. This lower apparent precocity of N'Dalore females is due to the fact that N'Dalore heifers have never been put in the presence of the bull before the age of 36 months, whereas N'Dama heifers and cows are generally kept in a single herd, without any particular precautions for breeding. According to VALLET (1988), the variation in age at first calving is physiological, pathological and linked to the management of reproduction. In the tropics, it can be assumed that females that have reached a weight

Table 1. Reproductive parameters and testicular qualities of N'Dalores males

Characteristics	N	N'Dalores			N	N'Dama		
		$\mu \pm DP$	IC	CV		$\mu \pm DP$	IC	CV
Age at puberty (days)	18	542,13 ^b ±3,2	7,22	3,83	16	458,3 ^a ±2,6	3,19	4,91
Weight at puberty (kg)	18	238,42 ^a ±0,8	19,13	2,81	16	168,7 ^b ±8,2	12,10	3,55
Height right testicle (cm)	18	7,8 ^{ab} ±7,6	5,02	3,42	16	9,6 ^{ab} ±2,47	3,09	2,27
Height left testicle (cm)	18	8,9 ^{ab} ±4,1	4,19	1,88	16	10,39 ^{ab} ±2,6	1,19	3,18
Scrotal circumference (cm)	18	25,6 ^a ±9,3	8,15	5,72	16	22,5 ^b ±1,5	2,03	2,09
Correlation between Scrotal Circumference - Weight	18	0,64 ^a ±2,5	9,32	4,24	16	0,48 ^b ±0,6	3,41	1,13

μ = mean; SD = standard deviation; N: number; CI: confidence interval; CV: coefficient of variation. The letters a, b, being different, the means are significant.

Table 2. Breeding performance of N'Dalores and N'Dama cows

Parameters	N	N'Dalores			N	N'Dama		
		$\mu \pm DP$	IC	CV		$\mu \pm DP$	IC	CV
Age at puberty (days)	32	512,23±8,12	13,40	5,33	28	472,47±1,41	8,17	2,09
Weight at puberty (kg)	32	198,33 ^a ±7,62	4,12	2,89	28	171,7 ^b ±10	6,14	3,90
Age at first calving (days)	32	1407,08 ^b ±51,43	17,22	2,78	28	1062 ^a ±1,6	11,12	0,58
Weight at first calving (days)	32	349,37 ^a ±9,28	3,12	3,25	28	217,6 ^b ±4	5,16	2,57
Estrous cycle length (days)	32	21,19 ^{ab} ±0,62	2,16	4,10	28	21,2 ^{ab} ±0,4	1,19	3,15
Length of gestation (days)	32	282,32 ^{ab} ±3,61	4,13	1,72	28	285,3 ^{ab} ±5,2	4,03	2,23
Postpartum cycle recovery (days)	32	81,84 ^{ab} ±7,16	8,51	2,24	28	73,6 ^{ab} ±2,7	6,34	1,41
Calving to calving interval (days)	32	537,32 ^b ±6,52	6,34	1,14	28	492,7 ^a ±1,7	3,14	0,23
Calving-to-calving interval (days)	32	255,78 ^b ±7,84	4,38	2,22	28	172,2 ^a ±0,4	2,82	1,09
Fertility	32	0,71±5,17 ^{ab}			28	0,64±0,10 ^{ab}		

μ = mean; SD = standard deviation; CI = confidence interval; CV = coefficient of variation; N = number. The letters a, b, being different, the means are significant.

Postpartum cycle recovery was 81.84±7.16 days. The Calving-Fecundation Interval is 255.78±7.84 days. The calving interval is 537.32±6.52 days and the fertility is 0.71±5.17.

DISCUSSION

In male N'Dalores the scrotal circumference was 25.6±9.3 cm, compared to 22.5±1.5 cm in male N'Dama, resulting in a gain of 3.1 cm. This gain in volume explains why the shape of the N'Dalores testicles is globular or oval. The scrotal circumference of the N'Dalores is almost in the same testicular size as the Nelores. It can be stated that the supply of blood from the Nelores to the N'Dama animals improves the testicular size of the N'Dalores. It is assumed that the sperm production of male N'Dalores is better than that of male N'Dama. According to WOLF et al (1965), knowledge of scrotal circumference predicts the reproductive potential of young bulls, as it is associated with testicular development, which is related to daily sperm production. The genetic determinism of reproductive performance is classically recognised as being strongly influenced by non-additive gene effects. Therefore, it can be said that this cross benefited from the phenomenon of favourable heterosis in the testicular characteristics of N'Dalores. The increase in testicular circumference in the N'Dalores, exceeding the values of the N'Dama,

corresponding to two thirds of the adult live weight of the breed in question are at an optimum level for fertilisation, known as the threshold weight. The interval between two calvings is 537.32 ± 6.52 days in the N'Dalores. Under the conditions of the Kila ranch, this long calving interval can be explained by the fact that the mother cows suckle for up to seven months in the pens and are only brought into contact with the males after weaning. This means that re-calving may not take place as soon, which further extends the interval between calving and mating. In addition, longer calving-calving intervals can also result in causes abortions. Such cows are then put back into breeding late. All calvings took place without intervention, indicating the excellent qualities of N'Dalores females with regard to calving ease. The fertility of the N'Dalores is 0.71±5.17, which is of the same order of magnitude as that obtained by MOPOUNDZA (2014) on N'Dama reared on semi-flooded pastures. This author concludes that in extensive farming, the good zootechnical performance of some cows, which are often in the minority, is masked by the poor zootechnical performance of other cows, which unfortunately are in the majority in the herd. Thus, on the Kila farm, whether it is the N'Dama or the N'Dalore, our results show that not one cow has been able to give birth every year. The reproductive performance of the N'Dama breed has been improved, and the N'Dalores have expressed interesting reproductive abilities, despite the age criterion used for breeding heifers at the Kila ranch. This

means that the age at first calving is delayed, not to mention the seven months of lactation, which lengthens the interval between mating and calving.

CONCLUSION

The results of the comparison of the reproductive parameters of the N'Dalores and the N'Dama revealed that the blood supply improved the performance of the N'Dama through the results of the male and female N'Dalores despite the management of reproduction at the Kila Ranch.

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