

# Performance of Reproduction of Two Crossed Cattle Breeds in the Marahoué Region in the Centre-West of Côte d'Ivoire

## ABSTRACT

This study aimed to evaluate and compare reproduction parameters of two crossed cattle breeds (Montbéliarde  $\times$  N'Dama = N'Damont) and (Holstein  $\times$  N'Dama = N'Damol) in the Centre-West of Côte d'Ivoire. To this end, 84 heifers of the second generation (F2) aged six (6) months from these crossings were selected for artificial insemination. A technical record was created for each heifer to monitor and record all technical data throughout the experiment.

At the end of the study, results showed that the prolificacy rate (61.90%) recorded in N'Damol heifers was similar to that observed in N'Damont heifers. However, N'Damont heifers had a higher gestation rate than N'Damol heifers with a difference of 14.29%, that was not statistically significant ( $p < 0.05$ ). The abortion rate in N'Damont heifers was 23.80%, while it was 9.52% in N'Damol heifers. The mortality rate observed in N'Damont heifers was double (15.38%) that recorded (7.69%) in N'Damol heifers, with a significant difference ( $p > 0.05$ ). The expression of the remarkable genetic potential of reproduction parameters of N'Damol crossed heifers constitutes a considerable asset for the development of these crossbreds and the expansion of cattle breeding in this region of Côte d'Ivoire.

**Keywords:** Performance, Reproduction, Crossed cattle, Montbéliarde, Holstein, N'Dama

## Introduction

Agriculture and livestock production are the principal sources of income for rural populations in Africa (Broutin *et al.*, 2021). In Côte d'Ivoire, these sectors employ two-thirds of the active population and contribute 25% to the Gross Domestic Product (GDP) and 50% to export revenues (ANStat, 2025). However, the production system of local breeds cannot meet the demand for animal protein among the population. This situation creates a dependence on external sources for the supply of meat and dairy products (Akaffou, 2013). With a population estimated at 32.7 million inhabitants in 2025 and an average annual growth rate of 2.7%, imports of animal protein to meet the consumption needs of the population remain a concern (MIRAH, 2025).

In response to this major economic constraint, the Ivorian government has undertaken actions aimed at developing cattle breeding. Indeed, among the strategies likely to significantly

increase local production is the improvement of the genetic potential of local breeds through crossbreeding programs between local cattle and exotic breeds (Koné, 2010).

Today, artificial insemination makes it possible to improve N'Dama cows, which are naturally trypanotolerant, by crossing them with sires of Montbéliarde and Holstein breeds. Given the interest generated by the crosses (Montbéliarde × N'Dama) and (Holstein × N'Dama), it appeared necessary to conduct a study to characterize their reproduction performance, which remains insufficiently documented. Thus, the present study aimed to evaluate the reproduction performance of these hybrid/crossbred cattle.

## Materials and methods

### Study Area

The study was conducted at the Ivorian Agro-Industrial Society of Marahoué (SIAM SA) in the city of Bouaflé in the Centre-West of Côte d'Ivoire (Figure 1). Bouaflé has a humid tropical climate, characterized by two rainy seasons and two dry seasons. The average temperature is 26°C, with peaks reaching 34°C during the dry season. Annual rainfall ranges between 1,100 mm and 1,200 mm. The city has 213,967 inhabitants with a predominantly rural and agricultural vocation (RGPH, 2021).



**Figure 1 :** Map of the Marahoué region showing the study area

## Materials

### Experimental Animals

The study was conducted on 84 heifers of the second generation (F<sub>2</sub>), of which 42 were from crosses (Montbéliarde × N'Dama = N'Damont) and 42 from crosses (Holstein × N'Dama = N'Damol).

### Identification Materials

The identification materials consisted of plastic ear tags bearing a code assigned to each animal.

#### Veterinary Products Used for Estrous Synchronization

For the induction and synchronization of estrus, three hormonal compounds were used:

- Delta PRID™ (Progesterone Releasing Intravaginal Device), a triangular intravaginal device containing 1.055 g of progesterone uniformly distributed in silicone elastomer.
- Synchromate™, an injectable solution of prostaglandin F2 $\alpha$  (PGF2 $\alpha$ ) supplied in 20 ml vials containing 25 mg of active ingredient.
- Folligon®™, a product composed of a vial of lyophilized PMSG (Pregnant Mare Serum Gonadotropin) to be diluted extemporaneously in 5 ml of physiological saline to obtain an injectable solution.
- Sterile lubricating gel, to facilitate the introduction of the insemination gun.
- Betadine™, iodine-based antiseptic solution applied to the genital area of the cow.
- Marseille soap, for cleaning the genital area of the cow.
- PRID™ applicator, for insertion of the spirals.
- Foam sponges, for estrous synchronization.

#### Artificial Insemination Materials

The artificial insemination equipment consisted of: Cassou insemination gun, protective sheath, sanitary sleeve, forceps, scissors, thermos with warm water (37°C) for thawing semen, temperature tester, light and sensitive palpation gloves, and restraint ropes.

#### Technical Record

A technical record was created for each heifer to monitor and record all technical data throughout the experiment.

#### Methods

##### Animal Selection

The selected animals were N'Damont and N'Damol heifers aged six (6) months in good general condition.

##### Feeding Management

The 'flushing' practice was used to optimize fertility. It consists of increasing the energy and protein density of the diet 2 to 3 weeks before insemination, and then 4 to 6 weeks after insemination. All selected animals were previously dewormed with Albendazole before starting the flushing protocol.

##### Estrous Synchronization

Animals were synchronized according to a protocol using Delta PRID, PGF2 $\alpha$ , and PMSG.

The protocol was as follows:

- Day 1: Insertion of Delta PRID in the vagina using a Delta applicator;
  - Day 6: Injection of prostaglandin (PGF2 $\alpha$ );
  - Day 7: Removal of Delta PRID, followed by injection of 500 IU of PMSG.
- Fifty-six hours after removal of Delta PRID, animals were inseminated.

#### Estrous Monitoring After Delta PRID Removal

Estrus appears 40 to 46 hours after removal of Delta PRID and is manifested by cervical mucus discharge at the ventral commissure of the vulva, vulvar congestion, bellowing, restlessness, tail deviation, and especially the acceptance of mounting.

#### Artificial Insemination

Animals were inseminated using the recto-vaginal method with a Cassou-type insemination gun. Semen stored in straws was previously thawed by placing the straws in water at room temperature for 15 to 30 seconds. Insemination was performed with semen from Montbéliarde or Holstein bulls according to the desired crossing.

#### Monitoring of Reproduction Parameters

Starting from day 30 post-insemination, early pregnancy diagnosis was performed by transrectal palpation of the genital tract. Pregnant and non-pregnant females were recorded. Pregnant animals were monitored until calving. Abortions occurring during pregnancy were recorded, as well as live births and stillbirths at parturition.

All collected data were used to calculate the following reproduction parameters:

- Gestation rate = (Number of pregnant cows / Number of inseminated cows)  $\times$  100
- Abortion rate = (Number of cows that aborted / Total number of pregnant cows)  $\times$  100
- Calving rate = (Number of live calves born / Number of inseminated cows)  $\times$  100
- Prolificacy rate = (Number of calves born / Number of cows that calved)  $\times$  100
- Calf mortality rate = (Number of dead calves / Total number of calves born)  $\times$  100

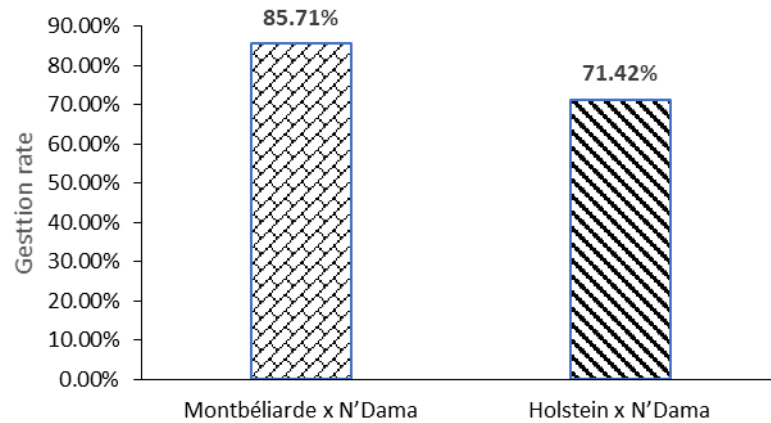
#### Statistical Analysis

Data analysis of recorded parameters was performed using R software version 2.10.1. The G test was used to compare percentages of each calculated reproduction performance. Values were analyzed at a significance threshold of 5%, and breed was the fixed factor for each reproduction parameter.

#### Results

##### Gestation Rate

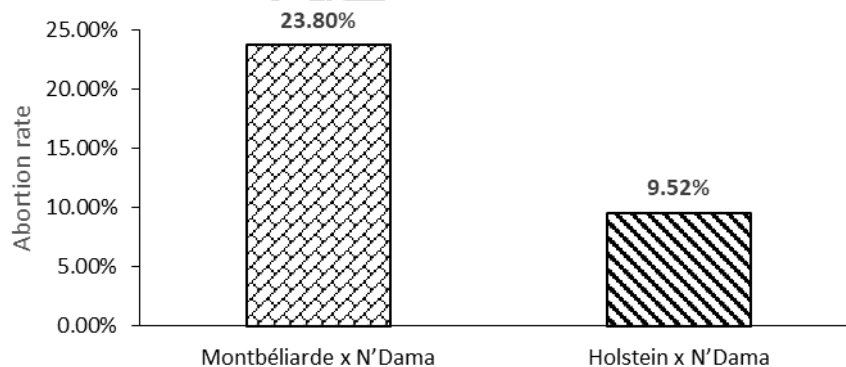
The gestation rate observed in N'Damol heifers was 71.42%, while it was 85.71% in N'Damont heifers (Figure 2). N'Damont heifers had a higher gestation rate than N'Damol heifers with a difference of 14.29%, which was not statistically significant ( $p < 0.05$ ).



**Figure 2 : Pregnancy rate of inseminated heifers**

### Abortion Rate

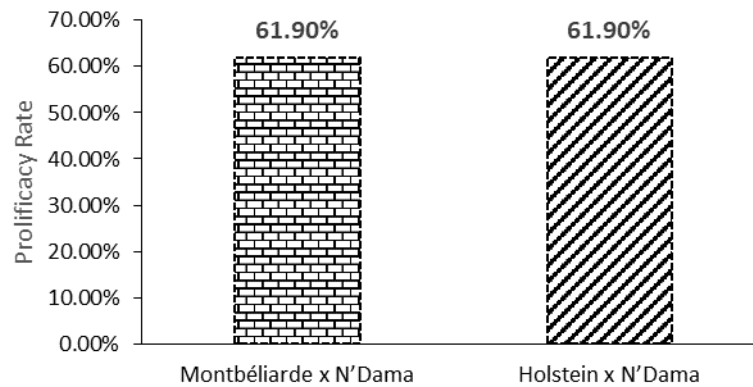
Abortions were recorded in both hybrid breeds (figure 3). The abortion rate observed in N'Damol heifers was lower compared to the abortion rates recorded in N'Damont heifers. The abortion rate in N'Damont heifers was 23.80%, while it was 9.52% in N'Damol heifers.



**Figure 3 : Abortion rate of inseminated heifers**

### Prolificacy Rate

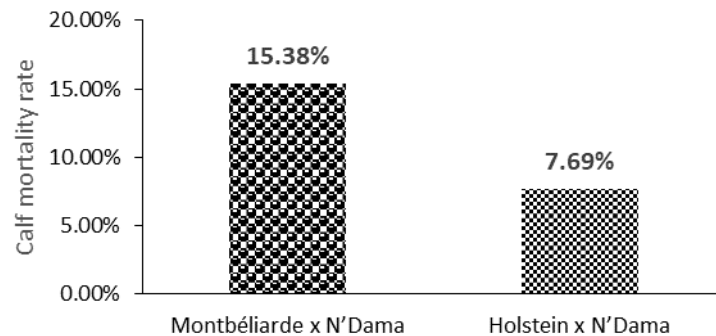
The prolificacy rate recorded in N'Damol heifers was identical to that observed in N'Damont heifers, at 61.90% without significant difference.



**Figure 4: Prolificacy rate of inseminated heifers**

### Calf Mortality Rate

The calf mortality rate observed in N'Damont heifers was double (15.38%) that recorded (7.69%) in N'Damol heifers, with a highly significant difference ( $p > 0.05$ ) (Figure 5).



**Figure 5 : Calf mortality rate**

### Discussion

The gestation rate of 85.71% obtained in N'Damont heifers is higher than that of 71.42% recorded in N'Damol heifers with a difference of 14.29%, which is not statistically significant. This difference could be justified by strict adherence to the insemination protocol. Indeed, at the time of estrus appearance in the heifers, the inseminators performed insemination in a consistently delayed manner. According to Bakrou (2021), the best success rates of artificial insemination are those performed more than ten hours after the onset of estrus until the moment of insemination. Furthermore, the gestation rate obtained with N'Damont heifers is similar to that reported (87.2%) by Aboly *et al.* (2021) in a study conducted in the mountainous West of Côte d'Ivoire on F1 N'Damont hybrid cows.

However, the gestation rate of N'Damol heifers recorded in this work is higher than that of Zebu cows (60%) observed in Katiola in the North of the country (Sokouri *et al.*, 2010). This result approaches the fertility percentage (72.20%) calculated by Parmar *et al.* (2016) using

the PGF2 $\alpha$  protocol in Indonesia. In contrast, Marichatou *et al.* (2004) revealed a gestation rate lower than ours, ranging between 63% and 64% in crossed females (Borgou  $\times$  Lagoon) synchronized with implants and PGF2 $\alpha$  in Benin.

The abortion rate (9.52%) observed in N'Damol heifers was lower compared to the abortion rates (23.80%) recorded in N'Damont heifers. These abortion rates would be due to an estrogen-progesterone imbalance in females that aborted. Stress at the time of insemination would be the source of this hormonal imbalance between estrogen and progesterone. Indeed, estrogen plays a crucial role in follicle maturation and oocyte release, while progesterone is essential for maintaining pregnancy and promoting embryonic development. Thus, an imbalance between these two hormones leads to poor migration of the fertilized egg in the oviduct and subsequently to impaired embryonic development. This can lead to abortion problems as noted by De Rensis & Lopez (2014).

Moreover, the production of anti-trophoblast antibodies locally in the genital tract of heifers can interfere with implantation and fetal development, resulting in fetal loss (Smith *et al.*, 2022).

Our results are comparable to those found by Sokouri *et al.* (2010). These authors reported an abortion rate of 8.3% in Zebu cows. However, these abortion rates are higher than those reported by Nyantudre (2001) in the peri-urban zone of Ouagadougou and Ouoba (2006) in Kouritenga, which are 6.41% and 6.25%, respectively, in Azawak and Goudali females.

The prolificacy rate recorded in N'Damol heifers (61.90%) was identical to that observed in N'Damont heifers. These results show that these hybrid heifers can better manage climatic stress. Furthermore, these heifers adapted well to humid tropical savannas. Indeed, this work was conducted during the dry season when climatic conditions are harsh in the study area, which results in a better prolificacy rate.

N'Damont heifers presented a mortality rate twice as high (15.38%) as that of N'Damol heifers (7.69%). The mortality observed in newborn calves would be linked to a lack of hygiene in the stables. This lack of hygiene would have led to the appearance of neonatal diarrhea, which began in calves of N'Damont heifers before spreading to other stables. This rate remains within the acceptable range in cattle breeding (18% to 25%) and is similar to that reported by Blagna (2017) at 7.6% in calves from local breed cows in Burkina Faso. However, optimization of good hygiene practices would contribute to improving herd health (Huzzey *et al.*, 2012).

## **Conclusion**

The results of this study on the reproduction performance of F2 hybrid heifers N'Damont and N'Damol revealed that these hybrid females have good aptitudes for improving the productivity of cattle breeding. However, the expression of the remarkable genetic potential of reproduction parameters of N'Damol crossed heifers constitutes a considerable asset for the development of these crossbreds and the expansion of cattle breeding in this region of Côte d'Ivoire.

#### **Funding Statement:**

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#### **Conflicts of Interest Statement:**

The authors declare no conflict of interest.

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