ISSN 2349-0837

REPRODUCTIVE PERFORMANCE OF MORADA NOVA EWE SUBJECTED TO ESTRUS INDUCTION BY MALE EFFECT

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ABSTRACT

This study aimed to evaluate the reproductive performance of crossbred sheep (New Address) nulliparous, primiparous and pluriparous, subjected or not to the male effect. There were used 79 ewes and two rams (one vasectomised ram – teaser ram) and a breeder). In the first year, the females were subjected to the male effect (ME: male effect), in the following year, there has been no application of this method (AME: absence of male effect). Ewes subjected to ME showed a higher synchronization (P <0.05) compared to AME females. Nulliparous and primiparous ewes subjected to ME exhibited a higher synchronization, in relation to ewes in the absence of male effect. When specified by birth order, there were superior results (P <0.05) within the same method (AME) for prolificacy index and twinning rate for pluriparous females relative to nulliparous and primiparous. There were also significant differences (P <0.05) for the use of the male effect, but with superiority of pluriparous and primiparous females when compared to nulliparous. Between the methods, ME primiparous females (72.22%) were superior (P <0.05) to AME ewes (33.33%) for twinning rate. Thus, it can be concluded that the male effect is feasible for estrus synchronization in ewes up to the first lambing birth, besides possibly causing better ovulation rate, due to better results of twinning rate and prolificacy index.

Indexing terms/Keywords

breeding season. ovulation. biostimulation

Academic Discipline And Sub-Disciplines

Animal Reproduction

SUBJECT CLASSIFICATION

Animal Management

TYPE (METHOD/APPROACH)

Sampling experimental survey

Council for Innovative Research

Peer Review Research Publishing System

Journal: JOURNAL OF ADVANCES IN AGRICULTURE

Vol .5, No. 1

www.cirjaa.com, jaaeditor@gmail.com

ISSN 2349-0837

INTRODUCTION

Considering the new trends and demands of society for food with higher content of protein nutrients, the sheep industry provides products of desirable organoleptic qualities. Among the breeds in production systems in the Ceará State, Morada Nova sheep have high fertility rate, with the occurrence of estrus throughout the year [1], prolificacy [2], adaptability conditions of the northeastern semi-arid region [3,4], in addition to having quality meat and highly appreciated skin, including on the international market [5].

Economic efficiency of production systems is related to the production of lambs for slaughter, which in turn is dependent on the reproductive performance that will enable an economic return [6], [7]. The intensification of production has driven a demand for management techniques aimed at maximizing production of lambs [8]. The establishment of a mating season has several advantages such as the ability to spread selected genotypes, breeding programs the births for favorable periods, thus increasing the survival of offspring, improving reproductive efficiency by controlling the age at first service, reducing inter-lambing-interval, as well as having low cost and easy to deploy and accomplish [9]. Allied to this, the male effect, a biostimulation from exposure of females to sexually active males resulting in a GnRH production pulse [10], which mediates the release of LH [11], with subsequent ovulation wihin 30 to 72 hours [9], [12], [13] and can induce estrus in all females subjected to male effect [14], above 80% in sheep [15]. This technique for estrus induction is an important factor in controlling reproduction [16-18], since society is increasingly concerned with animal welfare and food quality, giving preference for green, clean and ethical products [19].

Given the above, the goal of this study was to evaluate the reproductive performance of Morada Nova ewes, red variety, of different birth orders, nulliparous, primiparous and pluriparous, subjected or not to the male effect.

MATERIAL AND METHODS

The study was performed in two consecutive years [2011 (October 01 to November 11); 2012 (August 1 to September 11)] at the Forage-Animal Production Research Unit (NEEF/DZO/CCA/UFC), Federal University of Ceará, Fortaleza, located in the coastal zone, 15.49m asl, 3°3'02'' South latitude and 38°32'35'' West longitude, with average temperatures of 23.2°C (min) and 30.2°C (max), average relative humidity of 79% and average solar radiation of 147,592 cal/cm2.

Data on relative humidity (RH) and air temperature (TA) were collected from the weather station of the UFC, campus Pici, relative to the corresponding periods of the mating season of each year to obtain the temperature-humidity index (THI) according to Thom [20]: THI = 0.8 x AT + (RH (%)/100) x [(AT - 14.4) + 46.4] where: AT = air temperature in °C; RT = Relative humidity of air in %.

In the first year, we used 60 Morada Nova ewes with one to three birth orders, according to the birth order, 20 nulliparous (17.0 ± 1.0 months; 29.4 ± 3.4 kg; BCS: 2.6 ± 0.5), 20 primiparous (27.0 ± 1.0 months, 37.8 ± 5.0 kg; BCS: 2.84 ± 0.6) and 20 pluriparous (48.0 ± 6.0 months; 39.0 ± 3.0 kg; BCS: 2.41 ± 0.75) were subjected to the male effect (ME). In the second year, we used 59 crossbred ewes (Morada Nova x Crossbred), 20 nulliparous (15.0 ± 1.0 months; 24.7 ± 3.36 kg; BCS: 2.42 ± 0.62), 20 primiparous (27.0 ± 1.0 months, 31.1 ± 4.62 kg; BCS: 2.32 ± 0.77) and 19 pluriparous (37.0 ± 1.0 months; 36.1 ± 3.7 kg; BCS: 3.01 ± 0.72), not exposed to the male effect (AME: absence of male effect). Ewes were kept under semi-intensive system, in which the animals were taken to irrigated pasture of Brachiaria decumbens cv. Basilisk at night and during the day they received Tifton 85 (Cynodon spp.) hay, concentrate feed, mineral salt and water ad libitum.

Two male sheep were used, one teaser ram to induce estrus activity and identify females in estrus, and a Morada Nova breeder ram, which, at the breeding soundness examination, was considered fit to mate [21]. Both were feedlot raised, fed Tifton 85 (Cynodon spp.) hay, concentrate feed, mineral salt and water ad libitum.

In the first year, the breeding season was performed with the use of the male effect, so that the females and the males were placed in different locations, avoiding any contact 50 days prior to mating season. After this, the ruffian was introduced for induction and identification of the estrus in ewes. In the next year, the male effect was not applied, so there was no isolation of females from males, so the sheep kept olfactory, auditory and visual contact with other males of the flock, and on May 31st, 2012, when with 62 days for the start of the breeding season, the teaser ram was introduced into the flock.

The female was considered in estrus by detecting the moment of initial sexual receptivity of ewes, which were marked with ink by ruffian (RAIDEX MAXXI®). Observations were made during the day, from 7:00 to 17:00h, totaling 10 hours a day, with shifts (morning and afternoon) subdivided into four intervals (7:00 to 09:29h; 9:30 to 11:59h; 12:00 to 14:29h; 14:30 to 17:00h). At each interval, the females in estrus were taken to another pen and with subsequent controlled mating, two matings for each female, so that the ewes observed in estrus by the morning were mated in the afternoon, and subjected to the second mating in the next morning. Females induced to estrus in the afternoon were mated in the next morning, and the second mating was carried out on the afternoon of the same day. After mating, females were washed to remove ink from the lumbar region and reintroduced into the flock the next day. Pregnancy was confirmed by ultrasonography (CHISON® D600VET) with transrectal probe of 5.0 MHz at 30 and 120 days after the end of the breeding season.

To evaluate the reproductive performance of ewes, it was calculated the pregnancy rate, lambing rate, prolificacy index, twinning rate and the degree of synchronization (number of ewe in estrus in the first three days in relation to total sheep in breeding season, multiplied by 100) [22].

ISSN 2349-0837

Pregnancy rate, lambing rate, twinning rate, prolificacy, estrus induction and estrus repetition data were subjected to the Chi-square test (X2). The interval between the introduction of the male and manifestation of estrus was subjected to t-test. All data were compared between categories and methodology (ME; AME). Statistical tests were run using the statistical software SYSTAT 12 - USA. The results were considered statistically significant when P <0.05.

RESULTS AND DISCUSSION

Table 1 shows the results of successive mating seasons, with the male effect (ME) and absence of the male effect (AME).

Table 1. Comparison between the male effect (ME) and absence of the male effect (AME) on induction and synchronization of estrus of Morada Nova ewes.

Method	N	Estrus		OMEE (days)	DS		ER	
		n_1	(%)		n_2	(%)	n_3	(%)
AME	59	59	100	9.75±5.60	6	10.17^a	0	0
ME	60	59	98.3	8.95±5.36	15	25.00^b	5	8.33

ME: Male effect; AME: Absence of the male effect; OMEE: onset of the male effect appearance estrus (days); DS: Degree of synchronization (%); ER: Estrus repetition; n_1: ewes that expressed estrus; n_2: ewes in estrus within up to 5 days after the start of the male effect; n_3: ewes that repeated estrus. Values with different letters in the same column are statistically different (P <0.05).

The use or even the absence of the male effect had no interference with the percentage of females in estrus (p> 0.05). In the same way, [23] reported similar results for expression of estrus in Rambouillet ewes, which were apart of males compared to 86% that had contact vs 85%, respectively. Although there was no difference in the expression of estrus (AME: 100%; ME: 98.3%) is interesting to observe that its pattern occurred differently, as illustrated in Figure 1. This pattern in expression of estrus is related to the higher degree of synchronization (p>0.05) given by the male effect, unlike its absence, providing an increase exceeding 14%.

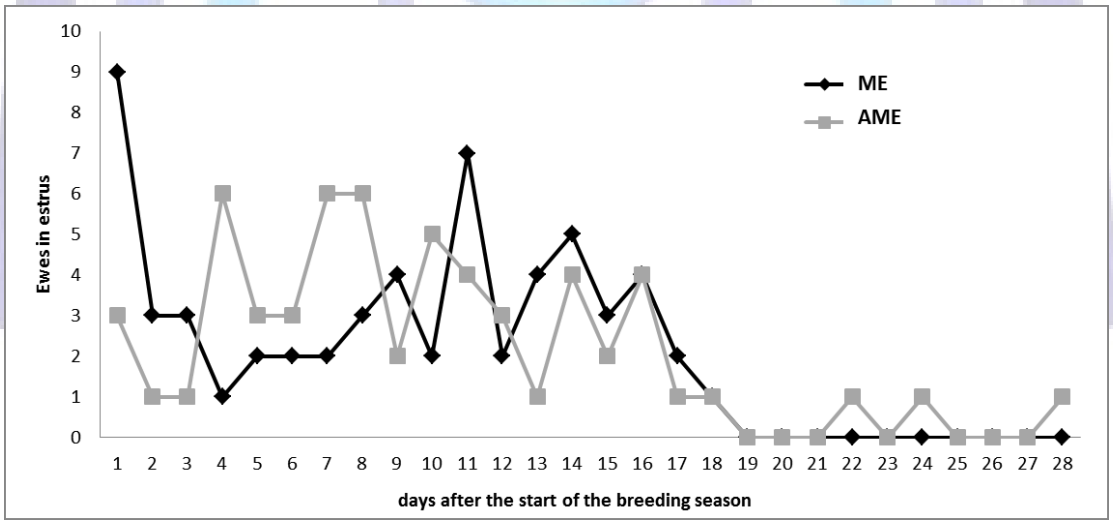

Figure 1. Expression of estrus of ewes subjected to the male effect (ME) or in the absence of the male effect (AME).

It was found an anticipated end of the breeding season for ewes subjected to the male effect, in which 98.3% of these animals expressed estrus up to the 18th day of the breeding season, whereas for the AME group, there was a 10-day extension with 100% of estrus expression occurring after 28 days. Results for ME are similar to those of [24], who obtained 92.37% of estrus in Santa Inês ewes synchronized by the male effect, concentrated in the first 15 days of the mating season. Still, [25] verified a 12-day shortening of the breeding season from 45 to 33 days in multiparous Anglonubian goats, emphasizing the importance of the male effect in reducing the kidding interval. This reduction can bring positive results for the production system, since it is desirable the concentration of managements in the production systems.

ISSN 2349-0837

For the ME, it was reached 25% degree of synchronization, where of the 60 ewes exposed to the male effect, fifteen showed estrous activity within the first 72 hours, whereas for AME group, it was 10.17%, significantly lower (P <0, 05), demonstrating the effect of the male effect on estrus synchronization (Table 2). The results for ME are similar to those of [26], who registered synchronization of 36.6% in sheep, when using only the male effect, although they have not described the methodology for the degree of synchronization.

Table 2. Comparison between the male effect (ME) and absence of the male effect (AME) on induction and synchronization of estrus of Morada Nova ewes, according to the category.

Method	N	BO	Estrus		OMEE (days)	SD		ER	
			n_1	%		n_2	%	n_3	%
AME	20	Nul	20	100	11.65±6.84	2	10.00^{B}	0	0
	19	Pri	19	100	9.00±5.21	2	10.52^{D}	0	0
	20	Plu	20	100	9.60±4.18	2	10.00	0	0
ME	20	Nul	20	100	7.35±4.63^{a}	6	30.00^{aA}	2	10.00
	20	Pri	19	95	7.16±5.75^{a}	8	42.10^{aC}	3	15.80
	20	Plu	20	100	12.25±4.19^{b}	1	5.00^{b}	0	0

ME: Male effect; AME: Absence of the male effect; Nul: Nulliparous; Pri: Primiparous; Plu: Pluriparous; OMEE: onset of the male effect appearance estrus (days); DS: synchronization degree; ER: estrus repetition; n_1: ewes that expressed estrus; n_2: ewes in estrus within up to 5 days after the start of the male effect; n_3: ewes that repeated estrus. Values with different letters in the same column are statistically different (P<0.05).

The birth order played a key influence on the interval between the introduction of the male and the onset of estrus and on the degree of synchronization. Pluriparous females belonging to the ME group had a higher OMEE (P<0.05) compared to nulliparous and primiparous animals, while primiparous ewes showed a higher degree of synchronization compared to other birth orders for the group ME.

This greater distinction in the OMEE was found between pluriparous relative to nulliparous and primiparous, in accordance with the perspective of reproductive immaturity of young females, which are still at the stage of physiological adjustments compared to females over two kiddings.

In Figure 2, the response of pluriparous females was more delayed and usually concentrated in the final third of the breeding season, with 65% of estrus expressions. Contrary to what was recorded by [27], who tested the male effect in Pelibuey ewes, and found that adult sheep responded significantly more to the male effect than nulliparous ewes during the anestrus season. In this work, it became clear the lack of dominance of older females in competition for male, thus ruling out the need for separation of females at birth order, as recommended by [28,29].

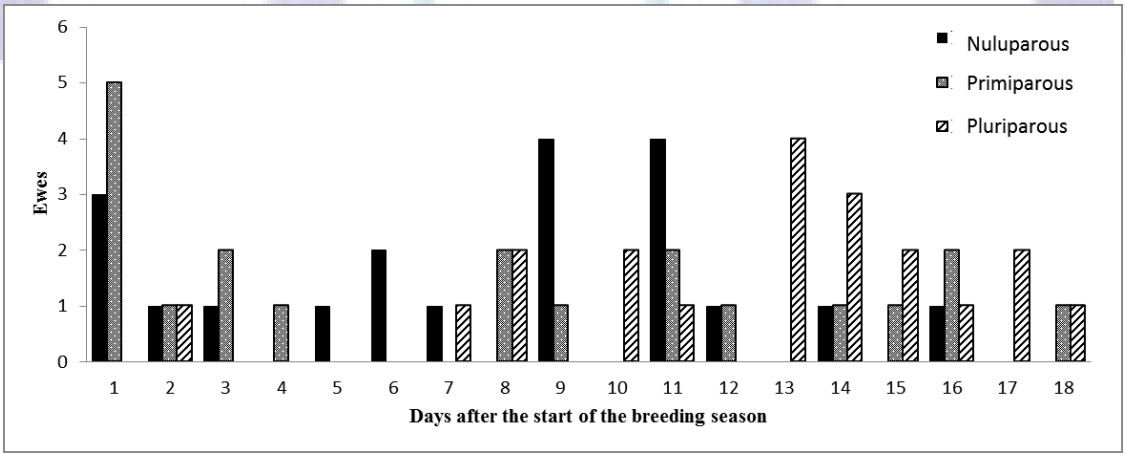

Figure 2. Expression of estrus in females exposed to the male effect (ME) in the different birth orders.

Regarding the degree of synchronization, when data are specified for each birth order, there was a greater influence of the male effect. Primiparous ewes ME (42.1%) showed better results (P <0.05) compared to primiparous AME (10.52%). The same was observed for nulliparous ME (30%) compared to nulliparous AME (10%). These results highlight the synchronization effect exerted by the male effect, which is probably related to the shortening of the luteal phase as

ISSN 2349-0837

suggested by [22], which noted that the introduction of the male is able to result in the increased LH anytime in the luteal phase. In turn, pluriparous females exhibited a degree of synchronization of only 5%, which is possibly related to sexual maturity of these sheep, maintaining regularity in the expression of estrus even with the distance and the reintroduction of males.

Although the primiparous ewes of the ME group have responded most to the male effect, they also showed higher estrus repetition (ER), 15.80% (Table 3). However, the ER results were not significantly different for any of the birth orders, regardless of the method. According to Oldham and Martin (1978, [30] there is normality in the occurrence of short cycles due to the male effect, with two peaks of activity, in which the first takes place 18 days after the introduction of the ram and the second six days later. These repetitions characterize normality, and, commonly, ewes present three or more estrus cycles during the mating season, until reaching positive pregnancy [30]. Nevertheless, for this study, there was no similarity for the results of the ME group, as even with the repetition of estrus in some ME sheep, estrus remained concentrated within only 18 days of the mating season.

Table 3. Reproductive performance of Morada Nova ewes exposed or not to the male effect.

Method	N	Pregnancy		Lambing		Twinning		Prolificacy
		n1	(%)	n2	(%)	n3	(%)	
AME	59	59	100	54	91.52	27	50.00	1.61
ME	60	59	98.3	54	90.00	36	66.70	1.85

ME: Male effect; AME: Absence of the male effect; Values with different letters in the same column are statistically different (P <0.05).

In general, there was no difference regarding reproductive rates. However, when specified by birth order, it was found a significant difference (P <0.05) in prolificacy and twinning rate; the results of prolificacy were higher than those of [32] with 1.38 and [33] with 1.051 (Table 4). The lambing rate was similar to those reported [34], 91%, and lower than in [35], 97.95%.

Table 4. Reproductive performance of Morada Nova ewes exposed or not to the male effect according to the birth order.

Method	N	BO	Pregnancy		Lambing		Twinning		Prolificacy
			n	(%)	n	(%)	n	(%)	
AME	20	Nul	20	100.00	19	95.00	3	15.79^{a}	1.16^{a}
	19	Pri	19	100.00	15	78.94	5	33.33^{aA}	1.33^{a}
	20	Plu	20	100.00	20	100.00	19	95.00^{b}	2.25^{b}
ME	20	Nul	20	100.00	18	90.00	7	38.89^{a}	1.39^{a}
	20	Pri	19	95.00	18	90.00	13	72.22^{bB}	1.94^{b}
	20	Plu	20	100.00	18	90.00	16	88.88^{b}	2.22^{b}

ME: Male effect; AME: Absence of the male effect; Nul: Nulliparous; Pri: Primiparous; Plu: Pluriparous. Values with different letters in the same column are statistically different (P <0.05).

When specified by birth order, there was also no influence of the male effect on the pregnancy rate, as well as the study carried out by [36] in cattle, showing no effect of biostimulation on pregnancy rates in beef heifers. [37] obtained 90 and 73% pregnancy rate for the groups of heifers biostimulatated or not, respectively. In addition, this closeness of results of pregnancy and kidding rates can be associated with the use of the male effect as routine management in the flock over the last six years and may have influenced the reproductive cyclicity of sheep. [38], when investigating Saanen goats, achieved satisfactory results only by using the male effect, and verified a progressive increase in kidding rates for eight consecutive years, from 72.21% to 86.26%, with only 80 minutes daily exposure.

Nulliparous and primiparous ewes demonstrated a lower prolificacy (P <0.05) compared to pluriparous ewes in the absence of the male effect, however, primiparous and pluriparous were superior (P <0.05) to nulliparous when undergoing biostimulation, showing an increased prolificacy of females exposed to the male effect.

In the absence of the male effect, twinning was higher (P <0.05) for pluriparous ewes, which is explained by the maturity of the reproductive tract. The adoption e the male effect caused primiparous and pluriparous sheep to be superior to nulliparous sheep on the number of lambs born, with a positive indication of the male effect influence, as primiparous ewes undergoing biostimulation presented a higher twinning rate (P <0.05), 72.2%, while sheep not exposed to ME

showed only 33.3% of multiple births. Furthermore, the values achieved for ME primiparous were similar (P> 0.05) to those obtained for ME pluriparous, therefore, the male effect stimulates better quality ovulations.

CONCLUSIONS

The Male Effect, in Morada Nova ewes, results in the shortening of the breeding season with increased prolificacy and twinning rate, with greater synchronization of estrus in primiparous females.

Therefore, biostimulation is a method suitable to be widespread in the Northeast flocks in Brazil, because of its low cost to the farmer and environmentally friendly, resulting in good reproductive performance.

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ISSN 2349-0837

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