



Insemination of dairy goats with estrus induced by the male effect during rainy and dry seasons in Northeastern Brazil

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ABSTRACT

This study aimed to evaluate the efficiency of biostimulation (Male Effect) through kidding rate of artificially inseminated goats during rainy (March-April) and dry (August-September) seasons of 2012 at Ceara, Brazil. The male effect was effective regardless of season, resulting in 94.5% of goats in estrus. The pregnancy rate for the dry season (57.6%) was proportionally higher than the rainy season (44.4%). However, the kidding rate has tended ($P = 0.074$) to be higher in the dry season. In general, the second estrus was more conducive to pregnancy, either to rainy or dry season. Thus, the artificial insemination of goats with estrus induced and synchronized by the male effect can be a feasible management resulting in satisfactory productive and reproductive index.

Indexing terms/Keywords

Estrus synchronization; animal reproduction; environmental temperature; THI.

Academic Discipline And Sub-Disciplines

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INTRODUCTION

Goats are distributed worldwide, with economic and social importance. To achieve an industrial production level it should be sought expertise and production improvement, which require the improvement in nutrition, climate conditions, health and reproduction and animal welfare. With regard to reproduction, adoption of reproductive biotechniques, as artificial insemination, which is easy to execute and able to generate favorable results for the rapid spread of beneficial genes [1]. Artificial insemination in goats should be preceded by induction and synchronization of estrus [2]. The exposure of females to the male goat (male effect or biostimulation; [3], occurs from the perception of male pheromones, which are captured by the olfactory pathways of female and act on the hypothalamic-pituitary-gonadal axis, increasing LH levels, culminating in ovulation [4].

The use of biostimulation in artificial insemination protocols is not a widespread alternative and its use is restricted to research, and even these provide little information about the state of the art. Studies such as [5] and [6] demonstrate the potential replacement of hormones by the male effect when used along with artificial insemination. Given the above, targeting a reproductive management employing artificial insemination, with a low cost and without the use of hormones, the aim of this study was to evaluate the effectiveness of biostimulation in artificial insemination of dairy goats in Northeastern Brazil.

MATERIAL AND METHODS

This study was conducted in Northeastern Brazil (Pacatuba, Ceará State, 3°53' S, 38°34' W, 70m), with humid tropical climate during the months March-April (rainy season) and August-September (dry season), in 2012. It was used 73 goats (Saanen; Saanen x Anglonubian) with average weight of 42.5 ± 8.41 kg and age of 26.0 ± 8.29 months. Four breeders, two Saanen and two Anglonubian, with average weight of 61.3 ± 8.53 kg and 47.3 ± 18.9 months of age, were kept in collective pen, 30m far from the pen of females undergoing soundness examination in accordance with the standards of the Brazilian College of Animal Reproduction [7], prior to each experimental period. This four bucks were used in rainy and dry seasons. The nutrition of the animals consisted of roughage, containing 70% of *Pennisetum purpureum* and 30% *Leucaena leucocephala* and concentrate containing 22.5% crude protein, added with vitamin-mineral supplement, and water *ad libitum*.

Data from ambient temperature (AT) and relative humidity (RH) were obtained using a digital thermohygrometer located in the pen of females, while performing the male effect, for obtaining Temperature and Humidity Index (THI, [8]), during the rainy and dry seasons. Estrus was induced by the male effect, without the use of exogenous hormones. Does were separated from bucks for a period of four weeks before the start of biostimulation. In the morning and afternoon, the buck was led to the pen of females under the supervision of the welder (to prevent mating), where it remained for 15 minutes in each pen. The goat was considered in estrus when it stood to be mounted by the buck [9].

Semen was collected five minutes before AI, using artificial vagina and an estrous goat. After collection, the semen was kept in a water bath (37°C) and analyzed for volume, color, appearance and mass motility. It was used semen with at least 80% of motility. After analysis, the semen was diluted with commercial saline solution to a final concentration of 200×10^6 sperm/dose, and packaged in 0.25 ml straws. Artificial insemination (AI) was performed transcervically 24-30 hours after detecting estrus, with the use of insemination pipette (IMV®, France), sleeve coated. All the material to be used for AI remained preheated onto hot plate (37°C) to avoid thermal shock. Pregnancy diagnosis was carried out 35 days after the last insemination, by ultrasound (CHISON®, D600VET).

Data of estrus induction, pregnancy rate and kidding rate were evaluated by nonparametric test, Pearson Chi-square test, at 5% probability, while the means of the interval between the onset of the male effect and manifestation of estrus, duration of estrus, the intervals from the onset male effect to estrus (OMEE) and to artificial insemination (OMEAI), and fertile estrus, were evaluated by parametric test, Tukey's t-test at 5% probability. Statistical analysis was performed using the software Systat 12 - USA.

RESULTS

Table 1 shows the mean values of ambient temperature (AT), relative humidity (RH) and temperature-humidity index (THI) for the rainy and dry seasons. There were no differences ($P > 0.05$) for the mean AT between seasons, but the mean values of RH and THI were higher ($P < 0.05$) in the rainy season. These values of THI characterized emergency situation for the rainy season, and dangerous situation for the dry season. Moreover, there was intense climate variability during the rainy season, which did not occur during the dry season. These changes, combined with high humidity, can be considered one of the reasons that resulted in lower reproductive efficiency in this period.

The male effect was effective in inducing estrus in dairy goats and can also be applied in combination with artificial insemination (Table 1). 94.5% of the goats showed estrus, without difference ($P > 0.9$) between the rainy (94.7%) and dry (94.3%) seasons. Only two females, in both periods, showed no estrus. A higher number of goats expressed estrus during the first week, in both seasons (Fig.1).



Table 1. Environmental data and efficiency of the male effect in inducing estrus in dairy goats, and their association with artificial insemination during the rainy and dry seasons in Northeastern Brazil.

Season	AT	RH	THI	n	Estrus (%)	OMEE	OMEAI	ED	N	Pregnancy (%)	Kidding (%)
Rainy	30.5	80.8 ^a	83.8 ^a	38	94.7	10.8	12.8	22.9	36	44.4	36.1
Dry	30.1	54.9 ^b	78.9 ^b	35	94.3	11.4	13.1	24.0	33	57.6	57.6
Mean	30.3	67.9	81.4		94.5	11.1	12.9	23.4		51.0	46.9

AT: ambient temperature; RH: relative humidity; THI: temperature-humidity index; n: number of animals; OMEE: onset of the male effect appearance of estrus (in days); OMEAI: onset of the male effect artificial insemination (in days); ED: estrus duration (h); N: number of inseminated goats. Different letters in the same column are significantly different ($p < 0.05$)

The duration of estrus (DE) was similar in both seasons, with an average of 23.4 hours. However, during the rainy season, a female showed estrus lasting 96 hours, while in the dry season, the maximum value was 48 hours. Pregnancy rate in the dry season (57.6%) was proportionally higher than in the rainy season (44.4%), but no significant difference ($P > 0.05$) was found. Nevertheless, the kidding rate tended to be higher ($P = 0.074$) during the dry season (57.6%) compared to the rainy season (36.1%).

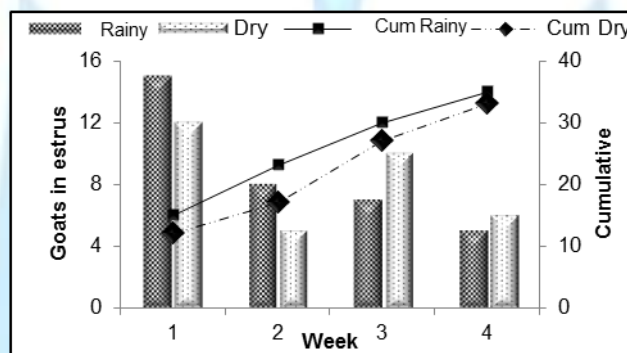


Fig1. Weekly and cumulative distribution of estrus (1st estrus) of dairy goats undergoing induction of estrus by using the male effect, for the rainy and dry seasons in Northeastern Brazil. (Cum. Rainy: cumulative rainy; Cum. Dry: cumulative dry).

In general, the second estrus was more conducive to pregnancy regardless of the period (fig. 2). Accordingly, during the rainy season, goats that had two or more estruses achieved 50% pregnancy. This was more evident for the dry season, when 11 goats that had only one estrus, only four became pregnant (36%) and one had pseudopregnancy. In turn, for 22 goats that had two or more estrous cycles, 68% became fertile.

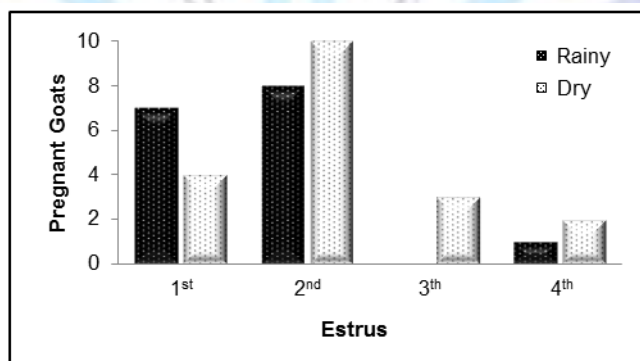


Fig2. Distribution of pregnant goats per estrus in which was inseminated and became pregnant, for rainy and dry seasons in Northeastern Brazil.

DISCUSSION

The present study pointed out that the climate acted directly on reproductive efficiency. [10] stated that the THI is directly related to the stress condition imposed to the animal, promoted by the environment. For this study, the values of THI are higher than those reported by [11] and [12], and above the ideal value proposed by [10]. In the reproductive context, heat stress can impair since the formation of gametes until fetal development [13], reducing reproductive efficiency [14], affecting reproductive functions [15], raising cortisol levels and as a consequence cause abortion [16], reduce LH



receptors in the follicle, the follicle growth rate and concentration of estradiol [17], influence the development of the conceptus [18]. [19] observed, in dairy cattle, that the higher THI values the lower pregnancy rates, so that for THI greater than 69, this loss showed values of 12%, and the risk of embryonic loss was 3.4 times higher for twin gestations compared with single pregnancies.

The male effect was effective regardless of season, because in the region where the study was conducted the animals remain sexually active throughout the year, which is the primary factor of the male effect [20], leading to a higher frequency of sexual behavior and favoring the quality of the stimulus [21]. These results are similar to [22] and superior to those of [23]. Thus, this study confirms the assertion of [24] who highlighted that in regions where the male effect is effective, hormonal treatments is not required.

The results for the interval between the onset of the male effect and the beginning of estrus (OMEE) were similar to [25] and [26], and distinct from those of [27] who reported a range of 2.5 ± 0.4 days. This longer interval observed in this study may be a result of different stages of the estrous cycle in which females were at, in the beginning of the male effect. [28] observed that, in sheep, the male effect is able to raise the levels of LH in any stage of the estrous cycle. Meanwhile, [29], observed no increase in LH levels during the mid-luteal phase in cyclic goats subjected to the male effect.

The results of pregnancy and kidding rate were satisfactory and superior to those of [30] when inseminated goats with estrus synchronized with medroxyprogesterone acetate, resulting in 36.5% pregnancy at first insemination. The variation in time of the LH surge, widely variable when employing biostimulation, may have affected the results of fertility, and thus arises as a setback for the association between the male effect and artificial insemination [31].

The season of the year affects pregnancy rate, as reported by [32] that obtained a 18% increase in pregnancy rate for the dry season compared to the rainy season. This tendency to a lower kidding rate for the rainy season is related to the embryonic loss resulting from climate action on the animal, since the thermal stress acts directly on the reproductive axis and may lead to reduced fertility [33], may be responsible for the release of prostaglandin, thus culminating in embryonic loss. [34] reported that embryonic loss during early pregnancy may stem from problems during transuterine migration. Therefore, the stress imposed to the female during early pregnancy can lead to physiological changes that will act on embryo viability, and consequently on its development. [35] showed that the transfer of quality embryo, in replacement of artificial insemination for dairy cows under thermal stress, resulted in better pregnancy rates.

The greater number of pregnant goats at the second estrus may be related to physiological regulation, which acts on the reproductive function, as registered by [36] who observed an increase higher than 20% in the amount of estruses followed by ovulation at the second estrus. Furthermore, [5] reported that the action of progesterone, even from a short cycle, favors the pregnancy rate of goats, and reported that only 19% of females conceived within five days, whereas between the sixth and tenth day the pregnancy rate was above 80%, and inferred that pregnancy rate for the first estrus induced is low and variable.

CONCLUSIONS

It can be concluded that artificial insemination of does with estrus induced and synchronized by the use of the male effect, performed 24 hours after the identification of estrus, is a simple and feasible management, it should be performed from the second estrus, once pregnancy and kidding rates obtained in this study were higher for females inseminated at this time of the breeding season. It is noteworthy that the rainy season negatively influenced the kidding rate. Nevertheless, the dry season is less harmful in terms of environmental discomfort, and more favorable to the use of artificial insemination in association with the male effect. Additional studies, with a larger number of animals, are needed to assess this artificial insemination protocol.

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