

# Duration of the breeding season on the reproductive performance of Anglo-Nubian goats during dry and rainy periods

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## Abstract

The study was aimed to evaluate the effect of breeding season (BS) duration on goat reproduction during dry (DS) and rainy (RS) periods. Females were kept 300 m apart from bucks for 60 days. Females were randomly distributed among BS groups of 25 (BS25), 35 (BS35), and 45 (BS45) days during DS and RS. All females cycled, except during BS45 in DS (95%). The duration of BS did not affect estrous incidence during DS and RS. The percentage of females with two estrous was similar in RS (BS25: 30%, BS35: 35%, BS45: 35%) and DS (BS25: 25%, BS35: 30%, BS45: 25%). Three estrous were observed in BS35 and BS45 during RS (5%). First estrous (FE) and second estrous (SE) were detected from days in BS25 (FE: 1-21, SE: 7-21), BS35 (FE: 1-23, SE: 6-27), and BS45 (FE: 1-23, SE: 9-20) during RS. During DS, estrous were detected within days BS25 (FE: 1-17, SE: 6-23), BS35 (FE: 1-20, SE: 6-24), and BS45 (FE: 2-21, SE: 6-21). Pregnancy rates were similar in RS (BS25: 90%, BS35: 95%, BS45: 95%) and DS (BS25: 75%, BS35: 80%, BS45: 75%). In conclusion, goat BS can be shorten despite weather without any effect on reproduction.

## Introduction

Goat production is performed worldwide and plays a major socioeconomic role, particularly

in developing countries. Despite the successful adaptation of goats to most climate conditions and feeding systems, goat farming remains heterogeneous on overall management practices, usage of modern technologies, and production yields. In order to circumvent these limitations, simple practices such as synchronization of kidding delivery by controlled mating offers cost-effective returns. In order to concentrate offspring delivery in short periods of time, estrous synchronization by hormone-based protocols allows the preparation of female lots for controlled mating, artificial insemination or embryo transfer.<sup>1</sup>

The male effect is a natural process in small ruminants that stimulates and synchronizes estrous cycles in anestrus and cycling animals.<sup>2-4</sup> The male effect is advantageous compared to hormone-based protocols due to its simplicity, low cost, limited animal handling and congruence with current demand for *hormone-free* livestock production systems.<sup>4</sup>

Much progress has been made on deciphering the male effect and its effect on female physiology,<sup>4</sup> particularly in sheep. However, to our knowledge, fewer reports have been aimed to refine its use under commercial conditions. For practical usage, the male effect has been suggested using intervals of two to four weeks for the preconditioning period.<sup>5-7</sup> Regarding the preconditioning distance, it has been suggested that a minimum distance of 1000 m between males and females should be practiced.<sup>7-8</sup> The rationality of this long distance was in order to completely avoid any interaction between animals of opposite gender (physical, olfactory, auditive and hearing contact). Recent reports have demonstrated that even physical isolation is dispensable for male effect in sheep and goats.<sup>4,9</sup> Moreover, most reports have evaluated the effects of the male effect on ovulation,<sup>4</sup> but pregnancy rates have not been described in most reports. Since recent discoveries on male effect have not been transferred to commercial breeding practices in small ruminants, a critical aspect of the procedure was revisited here. The aim of this work was to evaluate the effect of the duration of the breeding season during dry and rainy seasons on the reproductive performance of pluriparous goats.

## Materials and Methods

This study was conducted in Sertânia, Pernambuco state, Brazil. The geographic coordinates are 9.107.002 KmN and 691.005 KmE; altitude of 558 m and weather is semi-arid with 25°C average annual temperature, 431 mm<sup>3</sup> average annual rainfall, and rainy season from February to June.

One hundred and twenty pluriparous Anglo-

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Nubian females were used in the study (24 to 60 months of age). On the day before the start of the experiments, females received numbered plastic rings, were weighed and evaluated for body condition scoring (BSC) as previously described.<sup>10</sup> The reproductive status of the females was evaluated by ultrasound,<sup>11</sup> and vaginoscopy exam adapted from cattle.<sup>12</sup>

Three bucks (24 to 48 months of age) were kept in individual stalls before the experiment onset and fed with grass as described below and supplemented with 200 g of concentrated feed (Durrancho®, Nutrição Animal, Pesqueira, Brazil) and 200 g of corn grain (*Zea mays*, L)/animal/day. Bucks were kept apart from females at a distance of 300 m without visual, olfactory or hearing contact for 60 days.

Bucks were submitted to andrologic examination the day before the experiment and were used in an 1:20 male to female ratio.<sup>13</sup> When introduced into the female lot, bucks were marked with a mixture of grease and ink (4:1) around the sternum to facilitate identification of cycling females (bucks were re-marked with ink every 10 days). Mating events (females in estrous) were observed daily at 6.00 a.m. and again at 4.00 p.m. for one hour by trained personnel.

The DS was from September 9 to October 28, 2008 and the RS was from March 6 to April 19 of 2010. Breeding seasons (BS) had 25 (BS25), 35 (BS35) and 45 (BS45) days of duration, respectively. During the DS, females (n=60) showed average body weight of 38.35 at BS25 (n=20), 38.90 at BS35 (n=20) and 38.30 Kg at BS45 (n=20), and body condition scoring equivalent to 3.0. During the RS, female average body weight (n=60) was 37.35 at BS25 (n=20), 37.40 at BS35 (n=20), and 37.25 Kg at BS45 (n=20) and body condition scoring equivalent to 3.0. Pregnancy diagnosis was determined by ultrasound examination on the 60th day after the last mating of the BS, as previously described.<sup>11</sup>

The results were evaluated by descriptive statistical analysis, Student's T testing for comparing averages, chi-square for ratio comparison, and Fisher's test for comparing variances. Level of significance was 5%.

## Results

Females displayed one, two or three estrous throughout the experiment (Table 1). There was no influence of BS duration on number of estrous both in the DS and RS ( $P>0.05$ ). Estrous incidence was 100% at BS25, BS35 and BS45, except that 95% of the BS45 females cycled during the during the DS. These data do not show any influence of BS duration on the incidence of estrous in the DS or RS ( $P>0.05$ ).

The distribution of estrous events varied during each breeding season during both DS and RS (Table 2). Estrous were detected in the DS from day 1 until day 21 for the first estrous, from day 7 until day 21 for the second estrous in the BS25. At BS35, it varied from day 1 to day 23 for the first estrous and from day 6 to day 27 for the second estrous, and the third estrous occurred on the 24th day. At BS45, it

varied from day 2 to day 21 for the first estrous and from day 6 to day 21 for the second estrous.

Pregnancy rates were obtained at the end of breeding seasons during DS and RS (Table 3). During the RS, pregnancy rates varied from 90 to 95%, whereas during the DS it varied from 75 to 80%. There was no effect of breeding season duration on overall pregnancy rates during the RS and DS ( $P>0.05$ ).

## Discussion and Conclusions

The high incidence of estrous behavior regardless of breeding season duration and weather conditions confirms the remarkable and profound consequences of the male effect on female reproductive physiology. According to several authors, the sudden introduction of

**Table 1. Percentage of first, second and third estrous in Anglo-Nubian goats submitted to breeding season of different durations (BS25, BS35, BS45) during Dry (DS) and Rainy (RS) periods.**

Estrous (%)	Rainy season			Dry season		
	BS25	BS35	BS45	BS25	BS35	BS45
First	70	60	60	75	70	70
Second	30	35	35	25	30	25
Third	-	5	5	-	-	-
Total	100	100	100	100	100	95

**Table 2. Interval between estrous in Anglo-Nubian goats submitted to male effect in breeding seasons of different duration (BS25, BS35, BS45) during Rainy (RS) and Dry (DS) periods.**

Range	1 <sup>st</sup> estrous			2 <sup>nd</sup> estrous			3 <sup>rd</sup> estrous		
	Mn	Mx	Ave	Mn	Mx	Md	Mn	Mx	Ave
Dry season									
BS25	1	21	7.05	7	21	13.40	-	-	-
BS35	1	23	6.00	6	27	12.50	24	24	24.0
BS45	1	23	7.90	9	20	12.40	30	30	30.0
Rainy season									
BS25	1	17	7.35	6	23	14.40	-	-	-
BS35	1	20	6.85	6	24	11.62	-	-	-
BS45	2	21	6.36	6	21	10.37	-	-	-
Total	1	23	6.91	6	27	12.44	24	30	27

Mn, minimum; Mx, maximum; Ave, average.

**Table 3. Pregnancy rates in the first, second and third estrous Anglo-Nubian goats submitted to breeding seasons of different duration (BS25, BS35, BS45) during Rainy (RS) and dry (DS) periods.**

Estrous (%)	Rainy season			Dry season		
	BS25	BS35	BS45	BS25	BS35	BS45
First	60	55	55	55	60	60
Second	30	35	35	20	20	15
Third	-	5	5	-	-	-
Total	90	95	95	75	88	75

a buck or ram into the midst of isolated females increases LH pulsatility and provokes a preovulatory LH peak stimulating final follicular development and ovulation.<sup>2,5,14-17</sup>

Mating events are expected to be observed within an 15-25 day period after male introduction to the female herd.<sup>14,15,17,18</sup> These results and the data described here support the hypothesis that females can exhibit from one to three estrous within a 35-day period,<sup>17</sup> since female goats have estrous cycle ranging from 18 and 22 days,<sup>19</sup> but estrous cycles of less than 17 days have been observed.<sup>1</sup> Here, most female goats had one single estrous and only a small fraction exhibited three estrous during the DS (5%), and a second estrous was observed within an average period of 12.44 days. A plausible explanation for this short cycle would be due to a premature regression of the *corpus luteum*,<sup>19</sup> or insufficient secretion of P4 by *corpus luteum* with low luteal cell counts due to low-quality follicles.<sup>20</sup> Thus, a low serum concentration of P4 would be insufficient to block a LH peak of the dominant follicle during the first follicular wave after the first ovulation.

More importantly, the first estrous induced by the male effect is accompanied by physiological estrous behavior and ovulation with fertilizing capacity.<sup>2</sup> In accordance with this statement, in this study 55% to 60% of cycling females conceived in the first mating.

Pregnancy rates were similar between all breeding seasons, reinforcing the hypothesis that breeding seasons can be intensively shortened compared to previous recommendation of 45 to 60 days.<sup>3,21,22</sup> It has been recommended an 63-day breeding season for its implementation, and 49 days for subsequent breeding seasons.<sup>3</sup> Moreover, the duration of breeding seasons was determined based upon the estrous cycle of 21 days in goats and the experience of the farmer on overall management practices.<sup>3,22</sup>

Nutrition is a major factor on the reproductive performance of goats. Thus, it is important to note that the study took place under the semi-arid climate of northeast Brazil, similar to other tropical areas of the world were most of the goat population is found. These areas are predominantly characterized by limited disposability of quality forage, since both native vegetation and cultivated pastures hold low nutritional value, especially during the DS. The fact that pregnancy rates were similar during both DS and RS allows the assumption that the nutrition was not a confounding factor over the reproductive efficiency during the DS, due to forage supplementation with grass silage (*Pennisetum purpureum*, Schum).

In summary, the breeding season duration on RS and DS does not affect the reproductive performance of pluriparous female goats based upon estrous incidence and pregnancy rates. These findings highlight the potential of shortening goat breeding seasons to 25 days, allowing the reduction of investments on feeding supplementation and trained personnel for estrous detection and kidding delivery assistance.

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