Oestrus behaviour and performance i*n vivo* of Saanen goats raised in northeast of Brazil

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Abstract

In order to verify the oestrus activity and to observe the body weight of Saanen goats, when reared in intensive condition of Northeast Brazil during four different seasons, ten adult Saanen goats were used. In this experiment four climatic seasons were considered; early rainy (ER), late rainy (LR), early dry (ED) and late dry (LD). Oestrus behaviour was monitored twice a day (8:00 a.m. and 4:00 p.m.) during all the experiment, using two vasectomised bucks. The oestrus cycles were quantified within each season and classified as short (< 17 days), normal (17-25 days) or long (> 25 days). The goats were weighed every seven days.

During the late rainy season, a significant fall of the mean body weight of the animals was observed when compared to early rainy season. A larger percentage of goats in oestrus were observed during the late rainy season. Oestrus duration was longer in the late rainy and early dry season than in early rainy and late dry season. During the experiment, there were 12.0% of short cycles, 50.3% of normal cycles and 37.7% of long cycles. The percentages of abnormal cycles (short and long cycles), in relation to total cycles monitored in each season were 52, 58, 38 and 50% for early rainy, late rainy, early dry and late dry, respectively.

From the results of this study it can be concluded that pen-fed Saanen goats do not show seasonality for oestrus behaviour. Rainfall appeared to be an extero-receptive factor influencing the quality of sexual activity and performance in these goats.

Key words: goats, Saanen, reproduction, seasonality, oestrus, Northeast Brazil.

Introduction

Brazil has 1.18% of the world goat population (FAO 2000) with 94% of them in the Northeast region, confirming the great significance of this region for goat production (IBGE 1996). However, the productivity of goats in this area of Brazil is low. A partial explanation of this situation is that the native goats (eg: the Moxotó, Canindé and Marota breeds), although they present a perfect adaptability to environmental conditions, have a low dressing percentage when compared to breeds such as Boer goats (Malan 2000), or they show a low milk production, when compared to Saanen goats (Knights and Garcia 1997) when managed intensively.

In northeast of Brazil there is no clear policy for evaluating the local genotypes and little appreciation of their potential. Thus emphasis has been on the importation of specialized breeds, such as the Saanen, French Alpine and Toggenburg, the Anglo-nubian and Boer, which are maintained in their genetic purity or used in crossings with local goat breeds. The Saanen breed is the milk breed most widely used in the world for milk production and there are quite large numbers in Brazil (Ribeiro 1997). There are reports of Saanen goats, exploited in the tropics, with exceptional production, such as the 3,084 kg in 305 days of an Australian goat (Sands and McDowell 1978), confirming the productivity potential ability of this breed in the tropics. Alpine breeds originated in temperate countries, where they present sexual activity limited to a certain time of the year (Shelton 1978; Ortavant et al 1985; Chemineau et al 1992). In contrast, the native breeds of Northeast Brazil show sexual activity during the whole year (Silva Neto 1948; Simplício 1985; Simplício et al 1986). Therefore, the objective of this work was to verify the oestrous activity and to observe the body weight change of Saanen goats, reared intensively during four different seasons in tropical Northeast Brazil .

Material and methods

Period of experiment and environmental characterization

The experiment was carried out from April of 1998 to March of 2000 in the State University of Ceará, Fortaleza, which is located at 3^{o} 43'47 '' South and 38^{o} 30'37 '' West. The variation of photoperiod in this location is only 16 min between the solstices of the summer and winter. The region where the experiment was carried out is tropical and is characterized by small variation in annual temperature (26 to 28^{o} C). The highest rainfall is observed from January to June (FUNCEME 2000) (Figure 1).

In this experiment four climatic seasons were considered , which were described by Kronberg and Malechek (1997) as:

- ER – early rainy (January to March),
- LR – late rainy (April to June),
- ED – early dry (July to September) and
- LD – late dry (October to December).

Animals and experimental conditions

Ten adult Saanen goats were obtained from a private farm in Fortaleza, where the conditions were similar to those in the experimental location They were 15.6 $\pm$ 7.6 months old at the start of the experiment. In order to verify any reproductive disorder, ultrasonic examinations (Shimasonic, 3 MHz probe) were performed monthly during the experiment. The animals were maintained in typical ground-level housing used in Northeast of Brazil. In the morning, the goats received

Elephant grass (*Pennisetum purpureum*) *ad libitum*, while in the afternoon, they were supplemented with commercial concentrate (18% of crude protein). The animals had free access to water and to mineral salt. The goats were weighted every seven days, during the whole experiment.

Oestrus behaviour

Oestrus behaviour was monitored twice daily (8:00 a.m. and 4:00 p.m.) using two vasectomized bucks. Immobilization of the female when mounted by the male was considered to be a sign of occurrence of oestrus (Mauléon and Dauzier 1965). The number of oestrus cycles, as well as the length, were recorded during each season. The oestrous cycles were classified as short (< 17 days), normal (17-25 days) or long (> 25 days) (Chemineau et al 1992).

Statistical analysis

All calculations were performed with the GLM of the SAS statistical programme (SAS 1995). Length of cycle (d), length of oestrus (h) and body weight (kg) were submitted to two-way analysis of variance. The data of length of cycle and length of oestrous were transformed in log x. The following model of ANOVA was used:

$$y_{ij} = \mu + a_i + ß_j + e_{ij}$$

Where:

$Y_{i\ j}$ = observation;
μ = mean;
a_i = effect of individual *i*;
$ß_j$ = effect of seasons *j* (*j*= ER, LR, ED, LD);
$e_{i\ j}$ = error term e_{ij}

Differences between means of body weights were identified by the Duncan test. Comparison between percentages was performed by Chi Square test. Results were expressed as mean ± SEM and differences were taken as statistically significant at $P<0.05$.

Results

The rainfall in Fortaleza during the experimental period was similar to the mean monthly value for 30 years (1961-1990), indicating that the experimental period was representative of the climate for this area. Two different seasons were identified, which present a length of six months each: rainy (from January to June) and dry (from July to December).

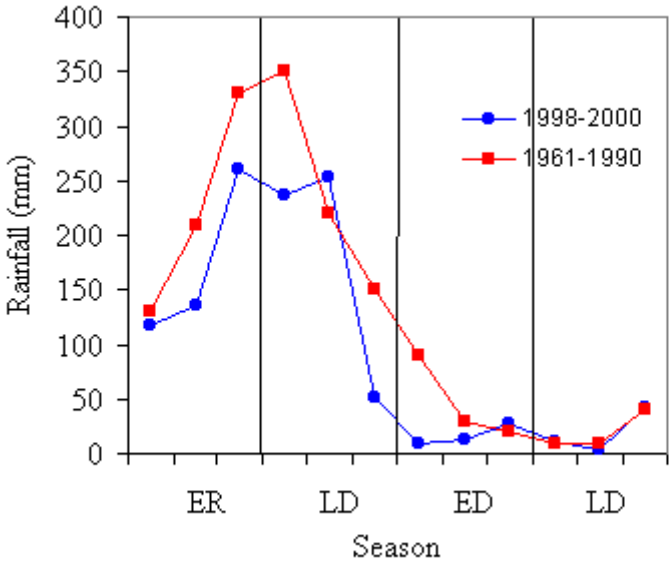

Figure 1: Mean monthly rainfall (mm) in Fortaleza during the early rainy (ER), late rainy(LR), early dry (ED) and late dry (LD) season from 1998 to2000(this experiment)andfrom 1961 to 1990 (FUNCEME 2000).

During the late rainy season, there was a significant decrease of the mean body weight of the animals when compared to the early rainy season ($P < 0.05$). During the early dry and late dry seasons, an increase ($P<0.05$) of body weight was observed (Figure 2).

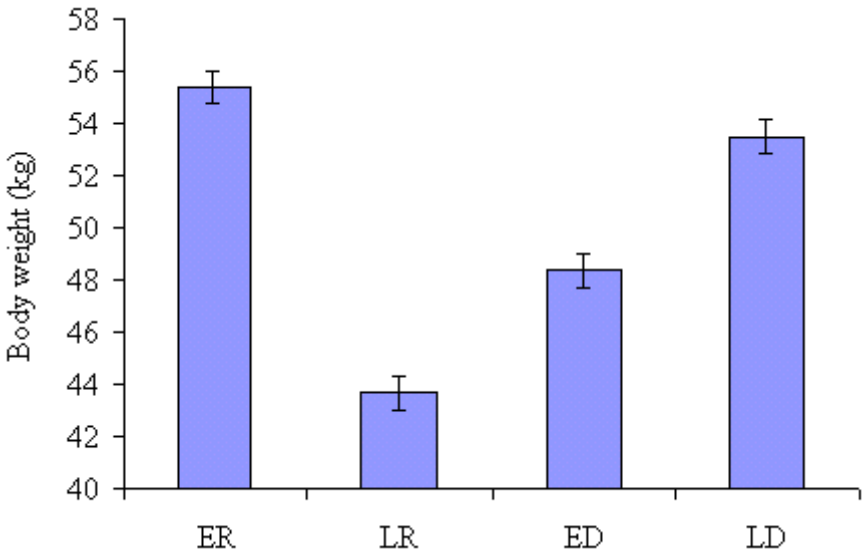

Figure 2: Body weight (mean ± SEM) of Saanen goats during the early rainy (ER), late rainy (LR), early dry (ED) and late dry (LD) season

It was observed that all the goats showed oestrus behaviour throughout the experiment. However, a larger percentage of goats in oestrus was observed during the late rainy season ($P<0.05$), while in the other seasons the percentage never exceeded 40% (Figure 3).

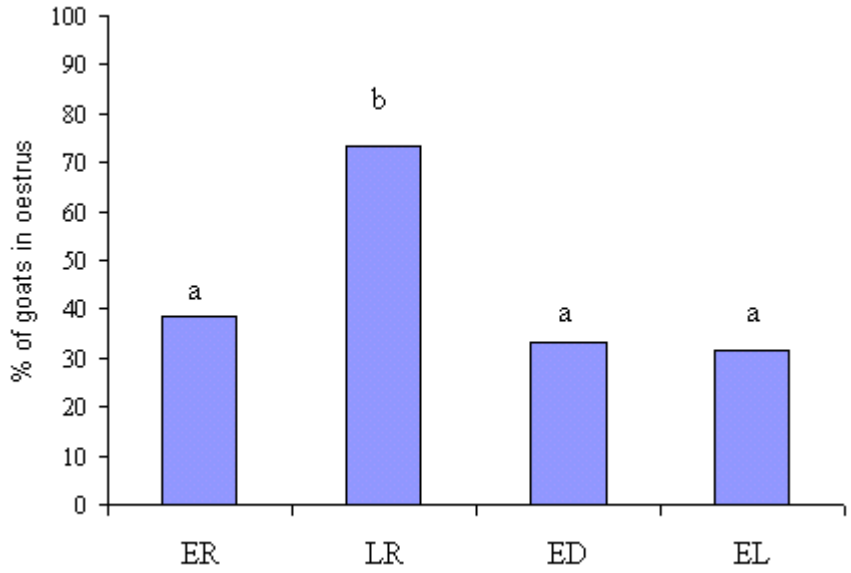

Figure 3: Mean percentage of Saanen goats in oestrus, explored in tropical area, during the early rainy (ER), late rainy (LR), early dry (ED) and late dry (LD) season (ab: Different letters among seasons indicate a difference at $P < 0.05$)

Table 1: Mean and SEM for length of oestrus (hours) and length of oestrus cycles in the different seasons

	Early rainy	Late rainy	Early dry	Late dry
Length of oestrus, hours				
All cycles	26.7 ± 2.54	34.9 ± 2.78	37.1 ± 3.48	28.4 ± 2.80
Normal cycles	32.5 ± 4.34	33.2 ± 2.75	36.0 ± 3.45	37.6 ± 3.44
Length of cycle, days				
Normal cycles	18.3 ± 0.36	19.3 ± 0.3	19.6 ± 0.22	19.2 ± 0.53

The minimum length of oestrus found in the experiment was 6h and the maximum 144 h. Season had no apparent effect on the duration of oestrus nor on the length of the oestrus cycle (Table 1). The mean length of oestrus for normal cycles, during the experiment, was 34.5 ± 1.69 h. The mean length of normal oestrus cycles was 19.1 ± 0.35 days.

A larger percentage of short cycles was observed in the late rainy season ($P<0.05$), when compared to the other seasons (Figure 4). Within the late rainy season, there were no differences in the percentages of short, normal and long cycles. In other seasons there were higher percentages of normal and long cycles compared to the short cycles ($P<0.05$). The minimum length of short cycle found was 2d and of long cycle was 305d. The percentage of abnormal cycles (short and long cycles), in relation to total cycles monitored in each season was 52, 58, 38 and 50% for early rainy, late rainy, early dry and late dry, respectively. The percentage of normal cycles was lower in the late rainy when compared to the early rainy and late dry ($P < 0.05$). In the same way, the percentage of long cycles was lower in the late rainy when compared to the early rainy and early dry ($P < 0.05$).

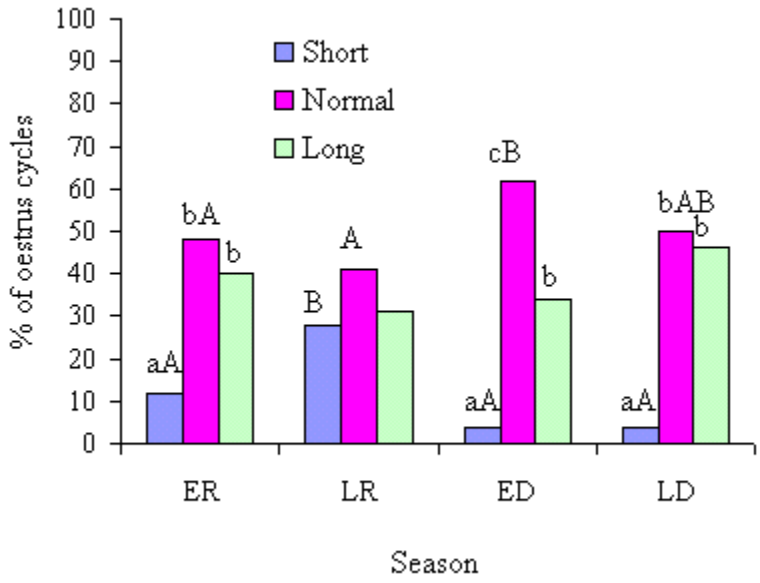

Figure 4: Mean percentage of short, normal and long oestrous cycles of Saanen goats,
during the early rainy (ER), late rainy (LR), early dry (ED) and late dry (LD) season.
ab Different small letters among types of cycles within seasons indicate difference ($P<0.05$).
AB Different capital letters for each type of cycle among seasons indicate difference ($P < 0.05$).

Discussion

In tropical areas and below 25^{o} latitude, the animal production is dependent on the forage availability throughout the year (Martin et al 1999). Overall, in the Northeast part of Brazil and during the rainy season there is abundance of forage, while during the dry season, the forage is scarce and fibrous and, consequently, of low quality (Lindsay et al 1993). In this experiment, despite the fact that the animals were in an intensive system, a significant fall of the body weight was observed during the late rainy season. Probably, this was due to the feeding habits of the goats. According to Knights and Garcia (1997), goats do not like forage with high moisture content, which results in a decrease of the feed intake and, consequently, a decrease of the body weight. Ogebe et al (1996) reported that Nigerian dwarf goats have reduced rumination rates during the rainy season, when compared to those of the dry season, due to the smaller amount of forage ingested, inducing a smaller absorption of nutrients and fall of the body weight. This hypothesis can be confirmed by the fact that the experimental animals recovered a great part of their weight during early and late dry seasons. However, the mean weight in the dry season still was inferior when compared to the early rainy.

The dry season in tropical areas is characterized by the low nutritive value of the natural forage. However, the body weight of the goats in this study increased in the dry season. In goats reared under grazing conditions, the browsing ability and the characteristic of selecting the most nutritious parts of the plant allow them to change their diet according to seasonal availability and growth rate of plants, and to increase their dietary protein intake during dry periods (Louca et al 1982). The effect of feeding selection was lower in our experiment, which was made in intensive conditions. Thus, it is possible that the environmental conditions observed in the late rainy season (high humidity) were responsible for the decrease of the feed consumption.

Seasonality of reproduction is a common feature in goat breeds of temperate latitudes, as well as animals of the Saanen breed, and photoperiod seems to be the key factor controlling reproduction in these areas (Shelton 1978; Ortavant et al 1985; Delgadillo 1990; Chemineau et al 1992). However, under tropical conditions, where the amplitude of photoperiodic changes is lower, it is known that local breeds of goats are either non-seasonal breeders or exhibit only a weak seasonality of reproduction (Chemineau 1986; Simplício 1985). In this experiment, it was observed that the highest rate of oestrus was in the late rainy season, which is characterized by the highest rainfall.

In goats, the oestrus length is approximately 36 hours (Phillips et al 1943; Mishra and Biswas 1966; Prasad and Bhattacharyya, 1979; Bliss 1980). Chemineau et al (1992) found a mean length of 30 hours, for oestrus in Alpine goats submitted to the temperate and tropical photoperiodic regimens. These data are in according with the results observed in our experiment. In goats, the oestrous cycles are classified in short (< 17 days), normal (17 to 25 days) and long (> 25 days) (Prasad

and Bhattacharya 1979; Gonzalez and Bury 1982; Eiamvitayakorn 1986; Smith 1986; Chemineau et al 1992). In Northeast Brazil, Simplício et al (1986) observed normal cycles with a mean (± SEM) length of 21.2 ± 0.45 days. The mean length of normal cycles observed in our experiment is similar to that observed by Chemineau et al (1992): 20.2 ± 1.0 and 20.0 ± 1.5 days for Alpine goats submitted to the temperate and tropical photoperiodic regimens, respectively. The percentage of short cycles in this experiment is in agreement the report from Chemineau et al (1987) of 14% of short cycles in Alpine goats subjected to a tropical photoperiodic changes. However, the long cycles observed in our experiment were more frequent (37.7% vs. 9.0%) then those observed by Chemineau et al (1987). Simplício et al (1986), studying SRD goats of the Northeast Brazil, found 11% of short cycles, 76.5% of normal cycles and 12.5% of long cycles. The high percentage of long cycles, found in our study (37.7%), indicates a certain degree of anoestrous, which was certainly related with the pseudo-pregnancy occurrence in some goats, diagnosed by ultrasonic examinations. The pseudopregnancy in goats is associated with the persistence of corpus luteum (Hesselink 1993) that induces the blockage of the hypothalamus-pituitary axis, inhibiting the return of reproductive activity (Kornalijnslijper et al 1997).

The high percentage of short cycles recorded in the late rainy season was also reported by Cerbito et al (1995) and Chemineau (1982), as being related to climatic factors, which act as important cues in the reproduction of goats. Cerbito et al (1995), working with native goats of Philippines, observed a negative correlation between the length of the oestrous cycle and the rainfall. The authors reported that a 76% increase in the rainfall corresponded to a decrease in the same proportion in the length of the oestrus cycles.

Despite the high percentage of oestrus observed during the late rainy season, this fact cannot be related to a better reproductive activity, because during this season it was observed the largest percentage of abnormal cycles, mainly of short cycles. The short cycles in goats are related to poor ovulation quality (Camp et al 1983). Thus, we cannot translate the high percentage of oestrus verified in the late rainy season as a parameter of good fertility nor of good reproductive performance. The loss in body weight during the late rainy season could be the factor related to poor reproductive performance.

Conclusions

From the results of this study it can be concluded that pen-fed Saanen goats do not show seasonality for oestrus behaviour when raised in Northeast of Brazil. Rainfall appeared to be an extero-receptive factor influencing the quality of sexual activity and performance in these goats. Thus, goat-breeding programs in Brazil under intensive management could benefit from more extensive use of Saanen goats due to the minimal seasonal effects on reproduction.

References

Bliss E L 1980 Dairy goat reproductive management. Dairy Goat Journal 58:12-13.

Camp J C, Wildt D E, Howard P K, Stuart L D and Chakraborty P K 1983 Ovarian activity during normal and abnormal length oestrous cycles in the goat. Biological Reproduction 28:673-681.

Cerbito W A, Natural N G, Aglibut F B and Sato K 1995 Evidence of ovulation in goats (Capra hircus) with short oestrous cycle and its occurrence in the tropics. Theriogenology, 43:803-812.

Chemineau P 1982 Reproductive performance in a “creole” meat goat flock at three mating periods. In: Proceedings of Third International Conference on Goat Production and Disease, Tucson, 1982. Abstract. Arizona, :162-174.

Chemineau P, Daveau A, Maurice F and Delgadillo J A 1987 Effects of tropical photoperiod on sexual activity of Alpine goats. In: Proceedings of Fourth Conference On Goats, Brasília, 1987. Abstract. Brazil: 269.

Chemineau P 1986 Sexual behaviour and gonadal activity during the year in the tropical Creole meat goat. I Female oestrous behaviour and ovarian activity. Reproduction, Nutrition, Developpement 26:441-452.

Chemineau P, Daveau A, Maurice F and Delgadillo J A 1992 Seasonality of oestrus and ovulation is not modified by subjecting female Alpine goats to a tropical photoperiod. Small Rum. Research 8:299-312.

Delgadillo J A 1990 Abolition des variations saisonnières de l’activité sexuelle chez le bouc par des traitements photopériodiques. Doctoral Thesis, Montpellier, France. 119p.

Eiamvitayakorn J 1986 Aberrant oestrous cycles in the goat (Capra hircus). MSc Thesis, Laguna, Philippines.

FAO 2000 Statistical database. www. fao.org.

FUNCEME 2000 Fundação cearense de meteorologia e recursos hídricos. www. funceme.br. .

Gonzalez S C and Bury N M 1982 Sexual season and oestrous cycle of native goats in a tropical zone of Venezuela. In: Proceedings of International Congress of Goat Production and Diseases, 1982. Abstract. Venezuela: 311.

Hesselink J W 1993 Incidence of hydrometra in dairy goats. Veterinary Research, 132:110-112

IBGE 1996 Anuário Estatístico do Brasil. Rio de Janeiro: IBGE. 715p.

Knights M and Garcia G W 1997 The status and characteristics of the goat (Capra hircus) and its potential role as a significant milk producer in the tropics: a review. Small Ruminant Research 26:203-215

Kornalijnslijper J E, Kemp B, Bevers M M, Van Oord H A and Taverne M A M 1997 Plasma prolactin, growth hormone and progesterone concentrations in pseudopregnant, hysterectomized and pregnant goats. Animal Reproduction Science 49:169-178

Kronberg S L and Malechek J C 1997 Relationships between nutrition and foraging behaviour of free-ranging sheep and gots. Journal of Animal Science 75:1756-1763

Lindsay D R, Martin G B and Williams I H 1993 Nutrition and reproduction. In: Reproduction in Domesticated Animals. World Animal Science: 459-491

Louca A, Antoniou T and Hatzipanayiotou M 1982 Comparative digestibility of feedstuffs by various ruminants, specifically goats. In: Proceedings of Third International Conference on Goat Production and Disease, Tucson, 1982. Abstract. Arizona: 122-132.

Malan S W 2000 The improved Boer goat. Small Ruminant Research 36:165-170.

Martin G B, Tjondronegoro S, Boukhliq R, Blackberry M A, Briegel J R, Blache D, Fisher J A and Adams N R 1999 Determinants of the annual pattern of reproduction in mature male Merino and Suffolk sheep: modification of endogenous rhythms by photoperiod. Reproduction, Fertility and Development 11:355-366.

Mauléon P and Dauzier L 1965 Variations de durée de l'anoestrus de lactation chez les brebis de race Ile-de-France. Annales de Biologie Animale, de Biochimie et de Biophysique 5:131-143.

Mishra H R and Biswas S C 1966 A study on distribution of oestrus in Deshi goats. Indian J. Dairy Sci., 19:132-144.

Ogebe P O, Ogunmodede B K and McDowell L R 1996 Behavioral and physiological responses of Nigerian dwarf goats to seasonal changes of the humid tropics. Small Ruminant Research 22:213-217.

Ortavant R, Pelletier J, Ravault J P, Thimonier J and Volland-Nail P 1985 Photoperiod: main proximal and distal factor of the circannual cycle of reproduction in farm animals. In: Oxford Reviews of Reproductive Biology, Oxford, 1985, England: 305-345.

Phillips R W, Simmons V L and Schott R G 1943 Observations on the normal oestrus cycle and breeding season in goats and possibilities of modification of the breeding season with gonadotropic hormones. American Journal of Veterinary Research 4:360.

Prasad S P and Bhattacharyya N K 1979 Oestrous cycle behaviour in different seasons in Barbari nannies. Indian Journal of Animal Science 49:1058-1062.

Ribeiro S D A 1997 Caprinocultura: Criação racional de caprinos. São Paulo: Nobel, 319p.

Sands M and McDowell R E 1978 The potential of goat for milk production in the tropics. Cornell Int. Agric. Dep. Anim. Sci., 60. 53p.

SAS 1995 SAS user's guide: Statistic, SAS Inst., Cary, NC.

Shelton M 1978 Reproduction and breeding of goats. Journal of Dairy Science 61:994-1010.

Silva Neto J M 1948 Primeira contribuição para o estudo do caprino nacional Moxotó. Sep. Bol.- Secretaria de Agricultura, Indústria e Comércio do Estado de Pernambuco, 15:1-49.

Simplício A A 1985 Reproduction in three native genotypes of goats under two feeding management systems in Northeast Brazil; Progesterone and luteinizing hormone profiles during the oestrous cycle and seasonal anestrus in Spanish goats in the United States. PhD Thesis, Utah, United States of America. 120p.

Simplício A A, Riera G S, Nunes J F and Foote W C 1986 Frequency and duration of oestrous cycle and period in genetically non-descript (SRD) type of goats in the tropical Northeast of Brazil. Pesquisa Agropecuaria Brasilera, 21:535-540.

Smith M C 1986 The reproductive anatomy and physiology of the female goat. In: Current Therapy in Theriogenology 2, Philadelphia, 1986.:577-579.