

## **Sexual behaviour and gonadal activity during the year in the tropical Creole meat goat. II. Male mating behaviour, testis diameter, ejaculate characteristics and fertility**

P. CHEMINEAU (1)

with the technical assistance of H. VARO and A. GRUDÉ

*I.N.R.A., Recherches Zootechniques,  
97170 Petit Bourg (Guadeloupe), French West Indies.*

---

**Summary.** An experiment was carried out for one year on six adult creole meat bucks to determine if there were any seasonal variations in spermatogenetic activity, mating behaviour or fertility.

Every month the animals were weighed, their testicular diameters recorded, volume and concentration of sperm of their ejaculates were measured, and sexual behaviour assessed. Fertility was measured in March, July and November after hand-mating.

Liveweight (37.5 kg) and testicular diameter (42.9 mm) did not vary significantly with the month but with the buck. The volume of the ejaculate (0.80 ml) did not vary with either the buck or the month, and sperm concentration ( $3.45 \times 10^9$  spz/ml) varied with the buck but not with month.

The number of matings (2.9) per behavioural test and the interval (98 s) between the onset of the test and first mating did not vary with the month or with the buck. Fertility rate (79 %) did not vary with the season of mating.

It was concluded that creole bucks are not seasonal breeders when maintained under good management conditions. However, large variations between males would be an important point to consider in a system where males are used intensively.

---

### **Introduction.**

A study of seasonal variation in the distribution of conception rates, when females were kept permanently with bucks, showed that fertility was higher at certain times of the year than at others (Chemineau and Xandé, 1982).

Objectives of the present experiment were to determine the role played by the bucks in this seasonal variation : are creole bucks, as those of European breeds in temperate climates (Rouger, 1974), high seasonal breeders ? Is the spermatogenetic activity of tropical bucks continuous all year round or very sea-

---

(1) Present address : I.N.R.A., Physiologie de la Reproduction, Nouzilly, 37380 Monnaie, France.

sonal as that of alpine bucks (Corteel, 1977) ? Does buck fertility, a direct consequence of sexual behaviour and sperm production, change with the season ?

We tried to answer these questions by studying seasonal variations of sexual behaviour, sperm production and fertility in adult creole bucks.

### **Material and methods.**

*Geography and Climate.* — The environmental conditions were those described in Chemineau (1986).

*Animals.* — Six adult creole male goats (see Chemineau, 1986) were used ; they were 2 to 4 years old and weighed 26,0 to 47,1 kg at the onset of the experiment. Animals were maintained permanently under shade and received *ad libitum* a forage diet (*Digitaria decumbens* and *Dicanthium caricosum*) plus 0.5 kg of concentrate (see Chemineau, 1986) daily.

*Measurement and sampling.* — The bucks were weighed monthly throughout the experiment from August 1981 to August 1982. Anterior-posterior testicular diameter was measured monthly with a caliper. Each testicle was measured three times ; the value recorded for each buck was the average of six values minus double scrotum thickness. In a preliminary experiment, measurement showed a very good repeatability within a day and from one day to another (correlation coefficient between measurements :  $r = 1.00$ ) and good correlation with testicular weight at slaughter ( $n = 36$  males ;  $r = 0.83$ ).

Once a month, each buck was presented to a female that was maintained artificially in induced oestrus. Oestrus was induced by twice weekly subcutaneous injections of 5 mg oestradiol benzoate each. Such a treatment was previously tested satisfactorily for the maintainance of oestrous behaviour in creole goats. The number of mountings and matings and the interval between behavioural events were recorded for 25 min (Mattner *et al.*, 1971).

Once a month behavioural tests and sperm collections by an artificial vagina were performed from each buck at two week intervals. Volume and sperm concentration of each ejaculate were measured. Such a collection frequency was sufficient to detect wide seasonal variations (Corteel, 1977).

In March, July and November 1981, and in March and July 1982 each buck was mated with she-goats whose oestruses had been detected by vasectomized bucks. At each mating period, all marked females were taken out of the flock in the morning (07:00-09:00 h) and after the first mating had been observed they were left with the intact male for 8-10 h. The total number of mated females per male and per day never exceeded 4 (Chemineau, 1983). Matings which were realized during oestruses which were followed by short estrous cycles, were attributed to female deficiency and consequently were not included in the fertility calculations. Thus, fertility was defined as the number of goats kidding divided by number of oestrous females mated to one buck.

*Analysis of results.* — Seasonal variations in liveweight, testicular size, volume and ejaculate concentration were analysed by analysis of variance (Bachacou *et al.*, 1981). Variations in the number of mountings and matings and of the interval between behavioural events were analysed by rank analysis of variance (Siegel, 1959). Variations in fertility rate were analysed by the  $\chi^2$ -test (Dagnélie, 1970).

## Results.

Liveweight (mean 37.5 kg) and testicular diameter (mean 42.9 mm) varied significantly ( $P < 0.001$ ) among bucks but not with the month of measurement (fig. 1). The total number of mountings recorded during behavioural tests (mean 7.9/test) varied significantly ( $P < 0.05$ ) among bucks and months of measurement. However the number of matings (mean 2.9) and the interval between the onset of the test and first mating (98 s) did not vary with bucks or months

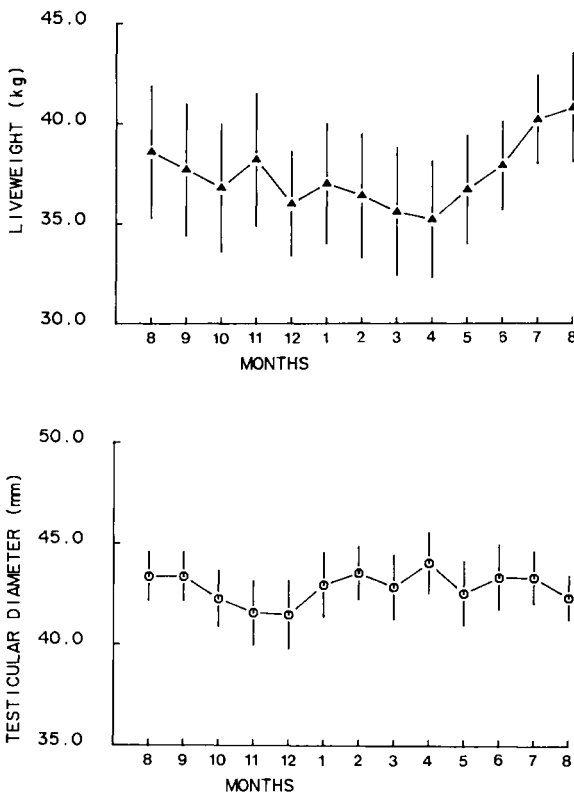


FIG. 1. — Seasonal variations in liveweight and testicular diameter in six adult creole bucks over one experimental year. M  $\pm$  SEM.

(fig. 2). The values for the months were very close to significance ( $P < 0.10$ ) and number of matings per test tended to increase during September and October.

The volume of the ejaculate (mean 0.80 ml) did not vary significantly with the buck or the month. The concentration of the ejaculate (mean  $3.45 \times 10^9$  spz/ml) varied with the buck ( $P < 0.05$ ) but not with the month (fig. 3).

Fertility rate (mean 79 %) varied with the buck but not with the month (table 1).

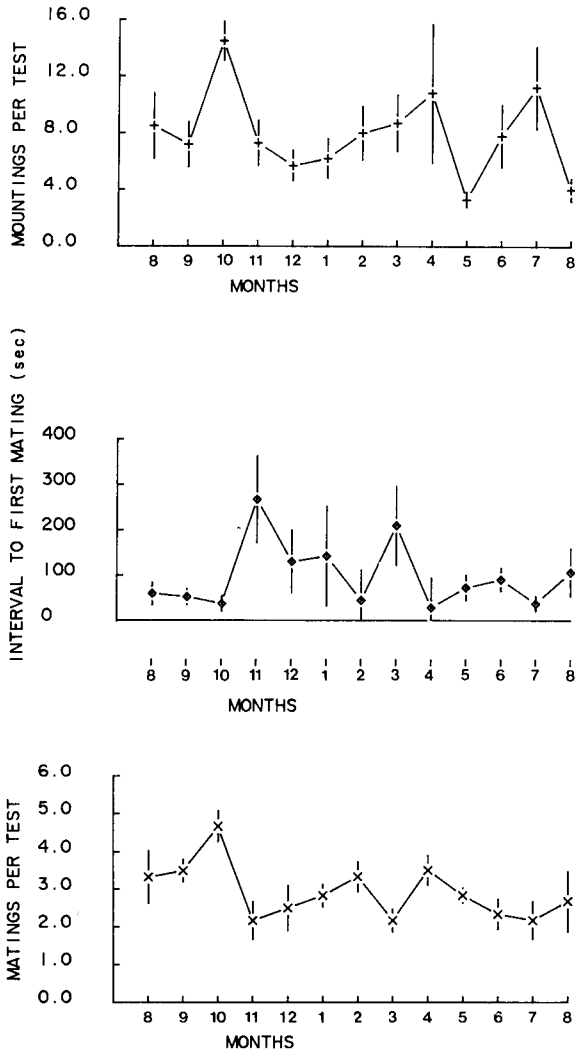


FIG. 2. — Seasonal variations in sexual behaviour in six adult creole bucks over one experimental year.  $M \pm SEM$ .

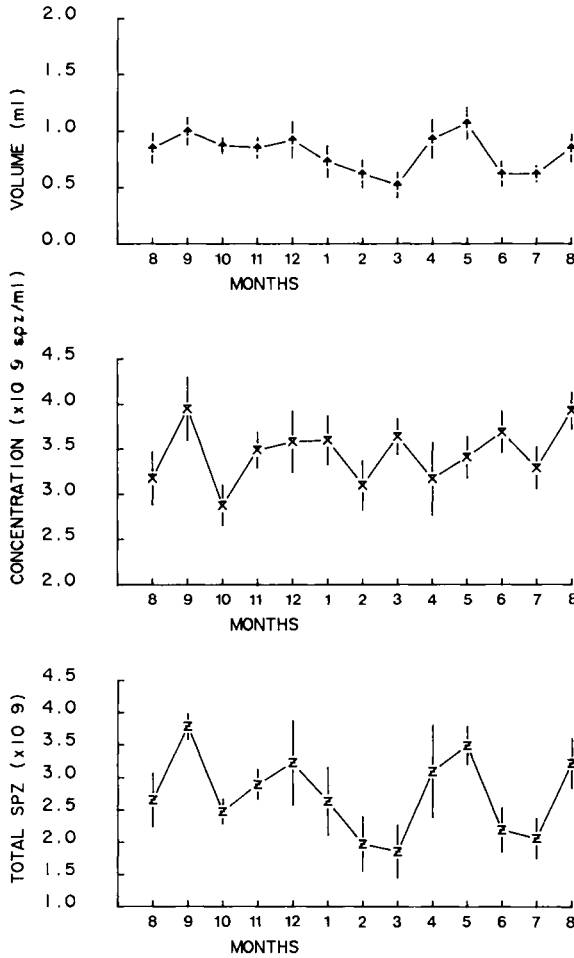


FIG. 3. — Seasonal variations in sperm production in six adult creole bucks over one experimental year.  $M \pm SEM$ .

TABLE 1

*Inter-season and inter-male fertility rates in adult Creole bucks.*

Mating period	March		July		November	
% Fertility	76 (67)		85 (59)		77 (65)	
Male number	1	2	3	4	5	6
% Fertility	79 (19)	82 (44)	69 (29)	87 (46)	92 (12)	70 (41)

Seasonal effect :  $\chi^2 = 0.62$  ; N.S. ; Buck effect :  $\chi^2 = 5.35$  ;  $P < 0.05$ .

Fertility = number of kidding females/number of mated females.

Number of separate oestruses for exposure is shown in parenthesis.

## Discussion.

Testis size, considered as a good indicator of spermatogenetic activity (Lindsay, 1984 ; Salau-Daudu, 1984), did not vary significantly with the month indicating that the spermatogenesis of creole bucks remained at the same level of activity from one season to another. However, bucks showed wide differences in testis size ; this observation, which had no consequences in our experimental conditions, would be an important point to consider if the males were to serve a large number of females. Absence of seasonal variation in spermatogenetic activity appeared to be very different from the observations reported in local small ruminant males in temperate climates in which testis size (Pelletier, 1971 ; Lindsay *et al.*, 1984 ; Branca, 1985, personal communication) or sperm crop (Corteel, 1977) varies widely with the season.

The activity of accessory sex glands showed no seasonal variation as ejaculate volume and sperm concentration did not vary significantly with the month of collection. This observation also differed greatly from the situation in seasonal breeders of temperate climates in which these two factors vary widely from the non-sexual to the sexual season, even when there are long intervals between collections (Phillips *et al.*, 1943 ; Eaton and Simmons, 1952 ; Corteel, 1977). This characteristic of unseasonality in creole bucks is probably of genetic origin as West African dwarf goats, which resemble creole goats, maintained in a temperate climate (Germany) and under a long-day photoperiod showed no seasonal variations in ejaculate volume, sperm concentration or number of sperm produced (Mann, 1981).

As observed for spermatogenesis and accessory gland activity, sexual behaviour showed no marked seasonal variation, although behavioural intensity tended to increase in September and October. As well as the other reproductive parameters studied here, the sexual behaviour of creole bucks differed from that of alpine bucks in France which show no mating at all during some months of the year (Rouger, 1974).

Fertility, a consequence of spermatogenesis and sexual behaviour, did not differ between the three seasons in which males were mated. However, significant differences appeared between bucks as to testis size.

In conclusion, creole bucks, as females of the same breed, are non-seasonal breeders when maintained in good management conditions in Guadeloupe. However, large variations between males described in the present study indicate that male selection before being put with females is an important point to consider in order to obtain good fertility.

*Reçu en septembre 1985.  
Accepté en novembre 1985.*

*Acknowledgements.* — I wish to thank J. Thimonier, Y. Cognié and W. W. Thatcher for their help during the experiment and in the preparation of this paper, and B. Chandi for excellent animal care.

**Résumé.** *Comportement et activité sexuelle au cours de l'année chez le Cabrit Créole de Guadeloupe. II. Comportement sexuel, diamètre testiculaire, caractéristiques de l'éjaculat et fertilité des boucs.*

Une expérience a été conduite pendant une année sur six boucs Créoles adultes pour essayer de mettre en évidence d'éventuelles variations saisonnières de l'activité spermatogénétique, du comportement sexuel ou de la fertilité.

Chaque mois les animaux sont pesés, les diamètres testiculaires sont enregistrés, le volume et la concentration en spermatozoïdes des éjaculats sont mesurés et le comportement sexuel est testé. La fertilité est appréciée en mars, juillet et novembre après lutte en main.

Le poids vif (en moyenne 37,5 kg) et le diamètre testiculaire (en moyenne 42,9 mm) ne varient pas significativement avec le mois de mesure mais varient avec le bouc. Le volume de l'éjaculat (en moyenne 0,80 ml) ne varie ni avec le mois de mesure ni avec le bouc ; la concentration de l'éjaculat en spermatozoïdes (en moyenne  $3,45 \times 10^9$  spz/ml) varie avec le bouc mais pas avec le mois de mesure.

Le nombre d'accouplements (en moyenne 2,9) par épreuve comportementale et l'intervalle (en moyenne 98 s) entre le début de l'épreuve et le premier accouplement ne varie ni avec le mois de mesure ni avec le bouc. La fertilité (en moyenne 79 %) ne varie pas avec la saison d'accouplement.

Les boucs Créoles de Guadeloupe, maintenus dans de bonnes conditions d'élevage ne manifestent pas de variations saisonnières de leur activité sexuelle. Les importantes différences entre mâles sont toutefois un aspect important à considérer dans un système où les mâles sont utilisés plus intensivement.

## References

- BACHACOU J., MASSON J. P., MILLIER C., 1981. *Manuel de la programmation statistique AMANCE, 1981*. Ed. I.N.R.A. Dept. Biométrie, 516 p.
- CHEMINEAU P., 1983. Effect on oestrus and ovulation of exposing creole goats to the male at three times of the year. *J. Reprod. Fert.*, **67**, 65-72.
- CHEMINEAU P., 1986. Sexual behaviour and gonadal activity during the year in the tropical creole meat goat. I. female oestrous behaviour and ovarian activity. *Reprod. Nutr. Dévelop.*, **26**, 441-452.
- CHEMINEAU P., XANDÉ A., 1982. Reproductive efficiency of Creole meat goats permanently kept with males. Relationship to a tropical environment. *Trop. anim. Prod.*, **7**, 98-104.
- CORTEEL J. M., 1977. Production, storage and insemination of goat semen, 41-57. In *Management of reproduction in sheep and goat symposium*. Madison (Wisc.), 24-25 juillet. Ed. Univ. Wisconsin.
- DAGNÉLIE P., 1970. *Théorie et méthodes statistiques*. Vol. II. Presses agron. Gembloux (Belgique), 451 p.
- EATON O. N., SIMMONS V. L., 1952. A semen study of goats. *Am. J. vet. Res.*, **13**, 537-544.
- LINDSAY D. R., 1984. Quantitative requirements of females for spermatozoa and output of spermatozoa by rams, 324-338. In M. COUROT, *The male in farm animal reproduction*. Nouzilly (Fr.), 6-7 Oct. 1983. Martinus Nijhoff Publ.
- LINDSAY D. R., PELLETIER J., PISSELET C., COUROT M., 1984. Changes in photoperiod and proteic nutrition and their effect on testicular growth of rams. *J. Reprod. Fert.*, **71**, 351-356.
- MANN J., 1981. Spermatological investigations in African dwarf goats (*Capra hircus* L.) kept in Germany. *Anim. Res. Dev.*, **14**, 86-100.
- MATTNER P. E., BRADEN A. W. H., GEORGE J. M., 1971. Studies in flock mating of sheep. 4. The relation of libido tests to subsequent service activity of young rams. *Aust. J. exp. Agric. anim. Husband.*, **11**, 473-477.
- PELLETIER J., 1971. *Influence du photopériodisme et des androgènes sur la synthèse et la libération de LH chez le bélier*. Th. Doct. Etat ès Sci. nat., Univ. Paris, 243 p.

- PHILLIPS R. W., SHOTT R. G., EATON O. N., SIMMONS V. L., 1943. Seasonal variations in the semen of sheep and goats. *Cornell Vet.*, **33**, 227-235.
- ROUGER Y., 1974. *Etude des interactions de l'environnement et des hormones sexuelles dans la régulation du comportement sexuel des Bovidae*. Th. Doct. Etat ès Sci. Nat., Univ. Rennes, 197 p.
- SALAU-DAUDU C., 1984. Spermatozoa output, testicular sperm reserve and epididymal storage capacity of the red Sokoto goats indigenous to northern Nigeria. *Theriogenology*, **21**, 317-324.
- SIEGEL S., 1959. *Non-parametric statistics for the behavioural sciences*. MacGraw-Hill Book Co. Inc., pp. 61-92 and 159-173.
-