

REPRODUCTIVE EFFICIENCY OF CREOLE MEAT GOATS PERMANENTLY KEPT  
WITH MALES. RELATIONSHIP TO A TROPICAL ENVIRONMENT

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The total number of kids born of 59 female meat goats known as "creole" goats, from 164 kiddings was recorded over a period of three consecutive years. The male goat was permanently kept with the females. Our research shows that March-April, June-July and September-October were the three periods most favourable for fertilizations, as fertility was high and 80% of the annual conceptions occurred during these periods. The average litter size was 1.80 kids/kidding; a highly significant correlation was observed between the number of kids born per kidding and the amount of rainfall in the month preceding fertilization. A significant seasonal variation of kidding-conception interval was observed (64 days for kiddings in June, July and August vs 102 days for the other months). For 30 females which had kidded more than twice during the three years under study, 2.62 kids were born per female and per year.

Key words: fertility, prolificacy, meat goat, tropical environment

A brief and once-a-year reproductive season is generally observed during the autumn in the female goats of temperate zones where daylength variations are recorded (Phillips et al 1946). In tropical areas where photoperiodic variations are reduced, do local breeds have a less seasonal reproductive pattern? Is this reproduction then, more sensitive to other environmental factors, such as feeding levels? This study investigated the periods of the year in which conception rates were highest in the "creole" goat of Guadeloupe, traditionally bred for meat production, and what relationship existed between the tropical environment and reproductive efficiency.

#### Materials and Methods

*Geography and climate:* The research farm is in the dry part of Guadeloupe (French West Indies, 16°10'N, 61°40'W). Annual rainfall is 1236 mm. Despite large variations between years it is possible to differentiate a rainy season (August to November: 755 mm) and a dry season (December to July: 481 mm). Maximum air temperature varies from 27°C (January) to 32°C (August) and minimum air temperature from 21°C to 25°C. Relative humidity is always above 55% and the daylength varies from 11 to 13 hours.

*Animals:* A flock of the local breed, or "creole" goats, was maintained on a Pangola (*Digitaria decumbens*) pasture without any bought-in concentrate. Females (with an adult weight of approximately 25 kg) were

Figure 1:  
Monthly distribution of conceptions and prolificacy of creole meat goats permanently kept with males (164 kiddings)

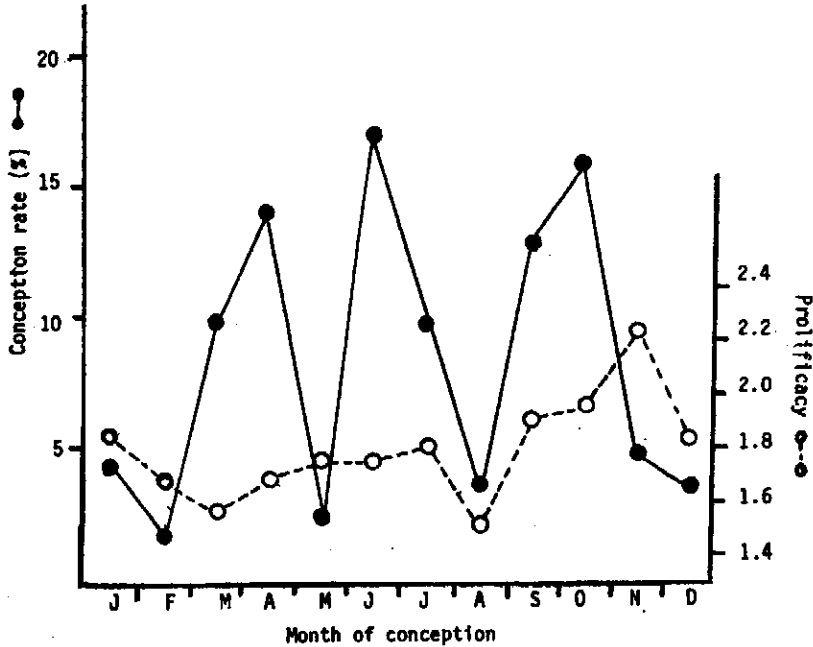


Table 1:  
Fertility and multiple kiddings of creole meat goats permanently kept with males

	Month of conception												Mean
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	
Fertility (%)	20	8	29	30	6	52	42	19	38	51	24	17	30 (164/ 545)
Percentage of multiple kiddings		70	44	65	3/4	68	75	3/6	81	69	79		68 (112/ 164)

Table 2:  
Mean kidding - conception interval according to month of kidding of creole meat goats permanently kept with males

	Month of kidding		
	Jan - May	July - August	Sept - Dec
Kidding - conception interval (days) $\bar{x} \pm SE$	$106^a \pm 5$	$64^b \pm 5$	$99^a \pm 8$
(N = number of kiddings)	(N = 42)	(N = 28)	(N = 43)

<sup>ab</sup> numbers with different superscripts are significantly different (P < 0.01)

permanently kept with at least one male of the same breed from 1975 to 1978. Kidding dates and the number of kids born were recorded from 1976 to 1979 for a total of 59 females. Kids were weaned at two months.

*Analysis of results:* Gestation lengths used for the calculation of conception date were determined in another experiment on the same breed: 146.0 days ( $SE_{\bar{x}} = 0.3$ ) for one or two kids (109 kiddings) and 144.4 days ( $SE_{\bar{x}} = 0.6$ ) for more than two kids (19 kiddings).

The monthly conception rate (%) is the number of conceptions observed during the considered month divided by the total number of conceptions in the year. The fertility rate (%) is the number of females fertilized during the considered period, divided by the number of females susceptible to be fertilized in the same period. A female was susceptible to be fertilized from thirty days after kidding (the smallest kidding-conception interval observed). The prolificacy is the number of kids per kidding. These two parameters were related to conception dates.

Variations in monthly conception, fertility and multiple kidding (prolificacy) rates were analysed with the Chi-square test (Snedecor and Cochran 1971). Kidding-conception intervals relative to the month of kidding were compared with a "t" test (Snedecor and Cochran 1971). Relationships between rainfall, daylength and reproductive parameters were analysed with the aid of rank correlations (Snedecor and Cochran 1971).

The mean number of gestations per female and per year (number of gestations divided by the number of months between first and last conception) and the mean number of kids produced per year (number of gestations per year multiplied by prolificacy) were calculated for 30 goats which had kidded more than twice during the three years studied (67% of total kiddings and 62% of total kidding-conception intervals).

## Results

*Reproductive efficiency:* Kiddings were observed all year round, but the distribution of monthly conception rate (Figure 1) was significantly different from the expected uniform distribution ( $X^2 = 40.35$ ;  $P < 0.01$ ). 24% of conceptions took place in March - April, 27% in June - July and 29% in September - October, or a total of 80% of annual fecundations occurred during these 6 months. In the same way fertility (Table 1), although always above zero, varied significantly according to season ( $X^2 = 88.28$ ;  $P < 0.001$ ). In March - April, June - July and September - October, fertility was 30%, 48% and 44% respectively, while it varied between 6% and 24% during the other months of the year.

Mean prolificacy was 1.80 kids per kidding. On a monthly basis, this parameter varied between 1.50 and 2.25 kids per kidding (Figure 1). The percentage of multiple kiddings (Table 1) varied significantly according to season ( $X^2 = 22.78$ ;  $P < 0.05$ ).

For 126 kidding-conception intervals the mean value was 112 days ( $SE_{\bar{x}} = 7$ ); 60% were less than 100 days and 90% less than 200 days (Figure 2). After discarding the larger-than-200-day intervals (mean 327 days;  $SE_{\bar{x}} = 4$ ), which were outside of the confidence limits of the mean and probably of pathological origin, the mean interval was 94 days ( $SE_{\bar{x}} = 4$ ). This interval varied significantly according to kidding season (Table 2), but not according to the number of kids born (1 kid : 86 days; 2 kids; 96 days; more than two kids: 102 days;  $P > 0.50$ ).

Figure 2:  
Distribution of kidding - conception intervals of creole meat goats permanently kept with males (126 kiddings).

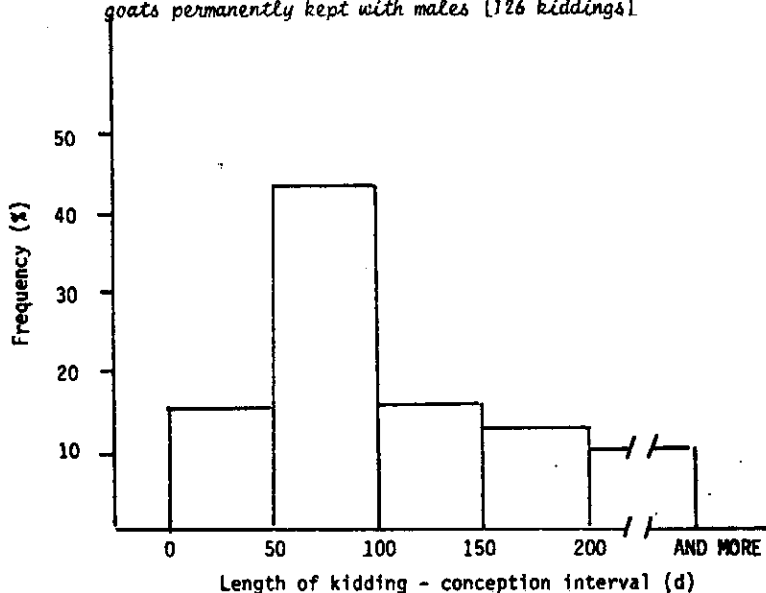


Table 3:

Rank correlations ( $r$ ) between tropical environment and reproductive efficiency of creole meat goats permanently kept with males

	<u>Rainfall</u> During the month of conception	<u>Daylength</u>	<u>Rainfall</u> During the month preceding conception
Monthly conception rate (%)	0.18	0.37	0.16
Monthly fertility (%)	0.03	0.41	0.07
Monthly prolificacy (%)	0.41	-0.55	0.91**
Kidding - conception interval (d)	0.13	0.46	0.10

\*\* Correlation coefficient significantly different from zero ( $P < 0.01$ )

*Relationship to a tropical environment:* No significant correlations existed between any of the above mentioned parameters and daylength or rain fall during the month of conception (Table 3). Prolificacy is the only parameter with a highly significant positive correlation with rainfall during the month preceding conception.

*Numerical productivity:* The mean number of gestations per female and per year was 1.40 ( $SE_x = 0.04$ ) and mean prolificacy was 1.88. So 2.62 kids were born per female and per year for the 30 female goats which had kidded more than twice during the three years under study.

### Discussion

In a "creole" female goat flock permanently kept with males, conceptions were observed all year round indicating a low reproductive seasonality. However, a seasonal pattern in the distribution of conceptions existed, defining three periods (March - April, June - July and September - October) when they occurred preferentially and during which fertility was high. The lower fertilities observed outside these periods indicate that they were months which were unfavourable for reproduction. It is, however, impossible to deduce from our results whether oestrus behaviour, ovarian activity, embryo survival or male fertility were implicated in this reduced fertility.

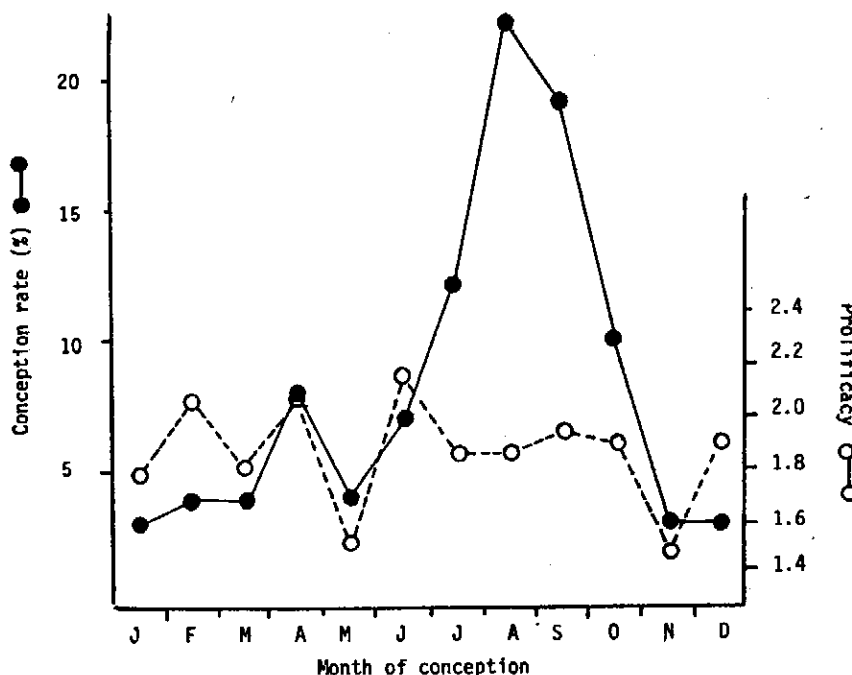
In the same breed but in small private flocks, Cognié et al (1971) observed a more pronounced seasonal distribution of conceptions (Figure 3), 63% occurring from July to October, thus defining a "principal reproductive season". However, conceptions occurred all year round. This difference between the two distributions of conceptions should mainly be attributed to the severe feeding restrictions existing from December to June which were more pronounced in private farms than in an experimental station where pasture management was carried out. In the same climatic zone Cognié (1971) observed ovulations all year round in more than 20% of females kept in a non-pregnant state, but all females were sexually active (oestrus and ovulation) from August to February.

In other tropical areas and for other local breeds, the existence of two or three seasons during which principal sexual activity was observed has already been described: Brown Savanna goat (Molokwu and Igono 1978), "local goat" (Rajkonwar and Borgohain 1978) and Deshi goat (Mishra and Biswas 1966). However, oestrus behaviour or conceptions occurred all year round indicating that these local goats bred in their traditional zones had a less marked reproductive seasonality than females of temperate zones (Phillips et al 1946). This characteristic seemed to be mainly of genetic origin as French Alpine female goats coming from Europe but born and bred in a tropical climate, maintained their short, and once a year reproductive season (Cognié 1971). Unfortunately we do not have any results on tropical breeds transported to temperate zones.

Mean prolificacy in this study (1.80 kids per kidding) is close to the 1.90 kids per kidding observed by Cognié et al (1971) but appreciably higher than that of Brown Savanna goats: 1.47 kids per kidding (Molokwu and Igono 1978). This high prolificacy of creole meat goats makes them particularly interesting for meat production. The percentage of multiple births varied according to season but did not seem to be directly related to fertility.

Figure 3:

Monthly distribution of conceptions and prolificacy of creole meat goats in private flocks (from Cognié, Houix and Logeay 1971) (307 kiddings)



As a matter of fact, prolificacy was related to rainfall during the month preceding conception. The reason for such a relationship undoubtedly lies in the influence of rainfall on pasture growth. Indeed, after one month's growth, Pangola is rich in crude protein and easily digestible (Chenost 1975). The intake of this young grass could thus induce an increase in the ovulation rate (Smith 1980) and a decrease in young embryo losses (Girouet al 1971) leading to an increase in prolificacy. A revision of the results found by Cognié et al (1971) showed that significant rank correlations also existed between rainfall (in the considered zone) in the month preceding conception and the monthly conception rate ( $r = 0.59$ ;  $P < 0.05$ ) and prolificacy ( $r = 0.57$ ;  $P < 0.05$ ). The lower correlation in this case is probably due to rainfall recordings far from flocks. For the three other above mentioned tropical breeds, there did not seem to exist the same relationship between rainfall and sexual activity. For the Brown Savanna goat more than 50% of annual conceptions occurred from November to March, which are months with no rainfall (Molokwu and Igono 1978).

The mean kidding-conception interval (94 days) was close to that observed in the same breed by Cognié et al (1971) of 90 days; and it is intermediate between the 79 days reported for the Brown Savanna goat (Molokwu and Igono 1978) and the 125 days reported for the West African Dwarf goat (Otchere and Nimo 1976). Seasonal variations in this interval, also observed by Cognié et al (1971), probably indicate an interaction between post partum and seasonal "anoestrus" as already indicted in the ewe (Mauléon and Dauzier 1965). The reproductive efficiency of the 30 superior female goats in this study demonstrated that the high reproductive rhythm and the good prolificacy in natural conditions enabled the animals to produce between 2.5 and 3.0 kids per female and per year.

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