TRADITIONAL SYSTEM OF GOAT MANAGEMENT.
III. REPRODUCTIVE PERFORMANCE OF SRD (NON-DESCRIPT) DOES AND KID MORTALITY[1]

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ABSTRACT - The reproductive performance of 50 adult SRD does maintained in native caatinga pasture at a stocking rate of 1 to 1.5 ha/head/year was evaluated. Two bucks were used in natural matings from September 1978 until December 1980. A total of 93 kiddings and 28 abortions occurred. Three pregnancies occurred before initiation of the experiment. From the 90 parturitions, 57.7%, 35.6%, 1.1% and 5.6% bore singles, twins, triplets and undetermined, respectively. The flock showed an overall prolificacy of 1.38. From the initial flock, 15(30%), 28(56%), 5(10%) and 2(4%) does presented one, two, three and zero kiddings, respectively during the period of study. Neither gestation length nor kidding interval were influenced by type of birth. Length of open period was influenced by season of the year when data were classified by season and kidding status at the open period. Combination of kidding type at previous and following kiddings showed a significant influence ($P < 0.05$) on the length of the open period. Animals which kidded first singles and then singles or twins showed a shorter open period than animals which firstly kidded twins and then aborted at the following pregnant (109 vs 188 days). The peak of kid mortality occurred between 7 and 112 days of age. Kid mortality appears not to be influenced by sex or type of birth. Overall kid mortality was 76%. The age at dead of kids was influenced by season and sex as well as by their interaction. Males born during the rainy season survived longer than any other class studied.

Index terms: native breed, reproduction, mortality.

SISTEMA TRADICIONAL DE MANEJO DE CAPRINOS.
III. DESEMPENHO REPRODUTIVO DE CAPRINOS SRD E MORTALIDADE DE CABRITOS

RESUMO - Avaliou-se o desempenho de 50 fêmeas de cabras SRD adultas mantidas em um piquete de pastagem nativa com uma lotação de 1 a 1,5 ha/cab/ano. Neste rebanho, dois reprodutores foram usados em monta natural de setembro de 1978 a dezembro de 1980. Foram observados 93 partos e 28 abortos. Ocorreram três prenhezes antes do início do experimento. Dos 90 partos restantes, 57,7%, 35,6%, 1,1% e 5,6% foram simples, duplos, triplos e não determinados, respectivamente. O rebanho mostrou uma prolificidade de 1,38. Para o rebanho inicial 15(30%), 28(56%), 5(10%) e 2(4%) das cabras pariram uma, duas, três e nenhuma vez, respectivamente, durante o período estudado. O período de gestação e o intervalo entre os partos não foram influenciados pelo tipo de nascimento. O período vazio foi influenciado pela estação do ano, quando os dados foram classificados por estação e tipo de parto. A combinação do tipo de parto, na parição inicial e na parição seguinte, teve influência significativa no período vazio. Os animais que pariram primeiramente simples e depois simples ou duplos apresentaram um período vazio menor (109 vs 188 dias) do que os animais que pariram primeiramente múltiplos e depois abortaram na prenhez seguinte. O pique de mortalidade (32%) ocorreu entre 7 e 112 dias de idade. A mortalidade de cabritos parece não ter sido influenciada pelo sexo e tipo de nascimento. A mortalidade total das crias foi de 76%. A idade à morte desses animais foi influenciada pela estação, sexo e interação de ambos. Os machos nascidos durante a estação chuvosa sobreviveram mais tempo do que os nascidos nas outras classes estudadas.

Termos para indexação: raça nativa, reprodução, mortalidade de crias, produção de crias.

INTRODUCTION

One of the major goals of the Brazilian National Goat Research Center (CNPC) - EMBRAPA is to develop simple and intermediate technologies which could be of value to small goat producers in increasing goat flock productivity.

The net return of an animal is strongly related to the reproductive capacity of the herd (Glimp 1971) since the performance in that area, closely

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associated with nutritional factors, determines its animal base. Improvements upon reproductive efficiency, such as identifying and culling infertile does and increase in the number of kids born per kidding within a period of time could be attained with simple husbandry measures. The initial step in this direction was taken by evaluating the pre - and post - weaning growth of native goats under traditional system of management (Lima et al. 1983, 1985). The research described in this paper intends to quantify the reproductive performance of the flock and the mortality of kids under the traditional system.

MATERIALS AND METHODS

Location

This work was carried out at the Brazilian National Goat Research Center (CNPC) - EMBRAPA, from September 1978 until December 1980. Climatological data of the area have been reported elsewere (Figueiredo & Pant 1982, Lima et al. 1983).

Animals and management

From the population of SRD (nondescript) does of the CNPC, fifty adult does were chosen at random and maintained within a fenced native "caatinga" pasture at the stocking rate of 1 to 1.5 ha/head/year. Two bucks were used in natural matings throughout the year. Identification of matings was possible by marking the bucks on the chest with a mixture of grease and powder color ink, changing color every fifteen days. Overall management of the herd was described elsewhere (Lima et al. 1983).

Data and statistical methods

From September 1978 to December 1980, a total of 127 kids were born out of 93 recorded parturitions. Data were obtained on several parameters as follows: Live weight of does: Data were recorded every 28-day interval. Doe body weights at the last two months of the gestation period were not considered for calculation of the average monthly weights.

Gestation length - At the beginning of the experiment, the mating dates were not recorded on every animal. Thus, the mean gestation length was calculated from 46 observations of which, 27, 18 and 1 gestation resulted in singles, twins and undetermided type of births, respectively. An analysis of variance (Steel & Torrie 1960) was carried out to determine the effect of type of birth on gestation length.

Kidding interval - The time lapsed between kiddings was calculated from 33 observations. Data were classified according to type of birth to test the effect of kidding status on kidding interval.

Open period - Defined as the time lapsed between the date of previous kidding and the date of mating leading to either a successfull kidding or to an abortion. Depending on the available number of observations data were classified accordind to the following criteria:

1. By season (rainy and dry), and kidding status (single and twins) of previous kidding, to test their effects on the length of the open period.

2. By season of previous kidding and by the combinations of previous and following kiddings status (single to single or twin, SST; Single to abortion, SA; Twin to single or twin, SST; and twin to abortion, TA) to test its effects on the open period interval. Analysis of variance was carried out by the method of weighted squares of means (Stell & Torrie 1960).

Kids mortality - During the period of study 97 kids died. Available data were classified according to month of birth, month of death, sex, type of birth and age at death. Out of 105 kids born during the year 1979, 75 died. Complete data were available on 73 animals. The general linear model procedure of least squares was used for analysis (Barr et al. 1979) to test the fixed effects of season, sex and type of birth on death age of kids.

RESULTS

Does'weight

A graph of the mean does'weigths every 28-days is presented in Fig. 1. It can be appreciated that variation of mean weights between months could be related to rainfall pattern and, in so doing, to fodder availability. The mean weight peak over 32.0 kg for the years 1979 and 1980 was reached during the month of August, while the lowest live weight mean, around 20.0 kg, was commonly reached during the month of January.

Parturitions and abortions

From September 1978 until December 1980 a total of 93 parturitions and 28 abortions were recorded, their monthly distribution are presented in Fig. 2. Of the total number of parturition recorded, three were from pregnancies which started before the initiation of the experiment, the remaining 90 parturitions produced 124 kids, distributed in 57.7%, 35.6%, 1.1% and 5.6% singles, twins, triplets and undetermined type of births, respectively, showing an overall prolificacy of 1.38. From the initial flock 15(30%), 28(56%), 5(10%) and 2(4%) does had 1, 2, 3 and zero kiddings, respectively, during the period of study.

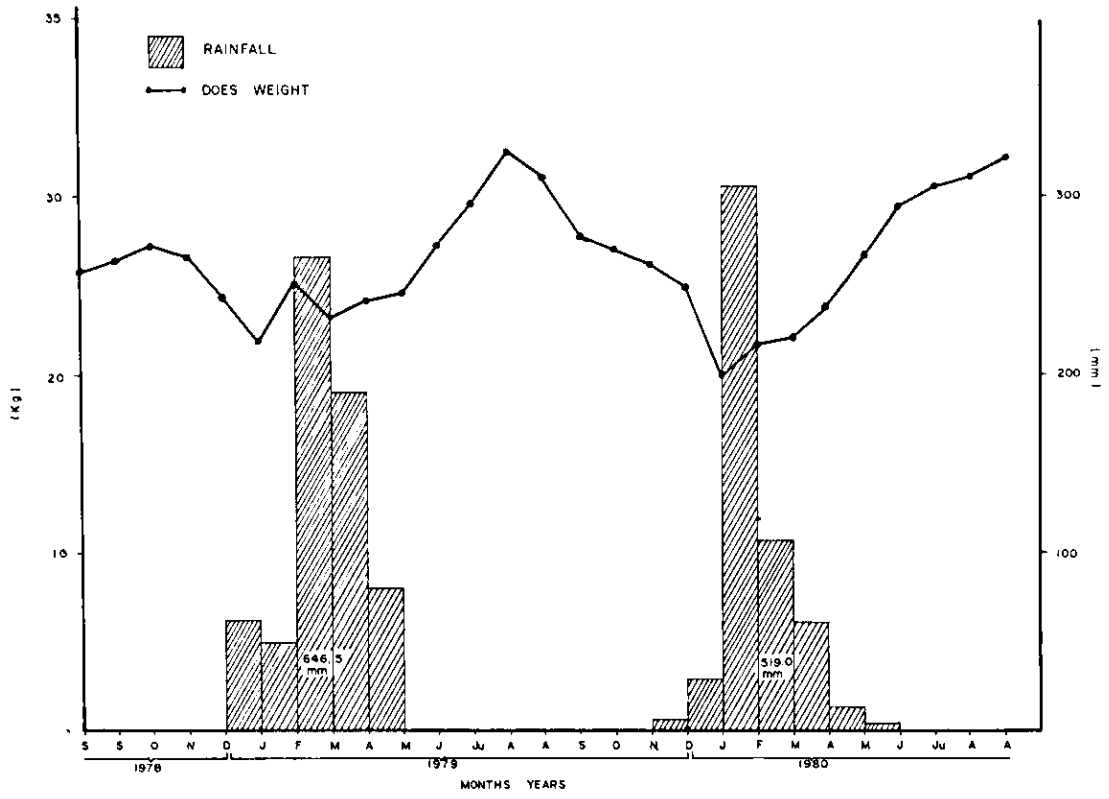

FIG. 1. Weight of does at 28 day intervals and rainfall pattern.

Out of 13 yearling does which were produced as replacements, only 4(31%) kidded within the period of study. Fifty three kiddings and 19 abortions occurred during the dry season while 40 kiddings and 9 abortions were registered during the rainy season.

Gestation length and kidding interval

Type of birth did not affect ($P > 0,05$) the length of the gestation period (Table 1). Mean gestation lengths were 146.1 and 145.1 days for single and twin gestations, respectively (Table 2). Kidding status, similarly, did not affect ($P > 0,05$) kidding interval.

Open period

Analysis of variance and least-square means are presented, respectively in Tables 3 and 4.

When data were classified according to season and kidding type at previous kidding, that is, at the beginning of the open period, the season was found to significantly ($P < 0,05$) influence the open period interval, this being shorter (124.8 days) when the open period began in the rainy season as opposed to the dry season (170.4 days). Kidding type of the does or the season x kidding status interaction did not influence the open period ($P > 0,05$).

Under the criteria of classifying data according to season at previous kidding and combination of kidding type at previous and following kiddings, it was found that combination of kidding type significantly influenced ($P < 0,05$) the length of the open period, while season or the interaction of both main effects were not important. Does wich

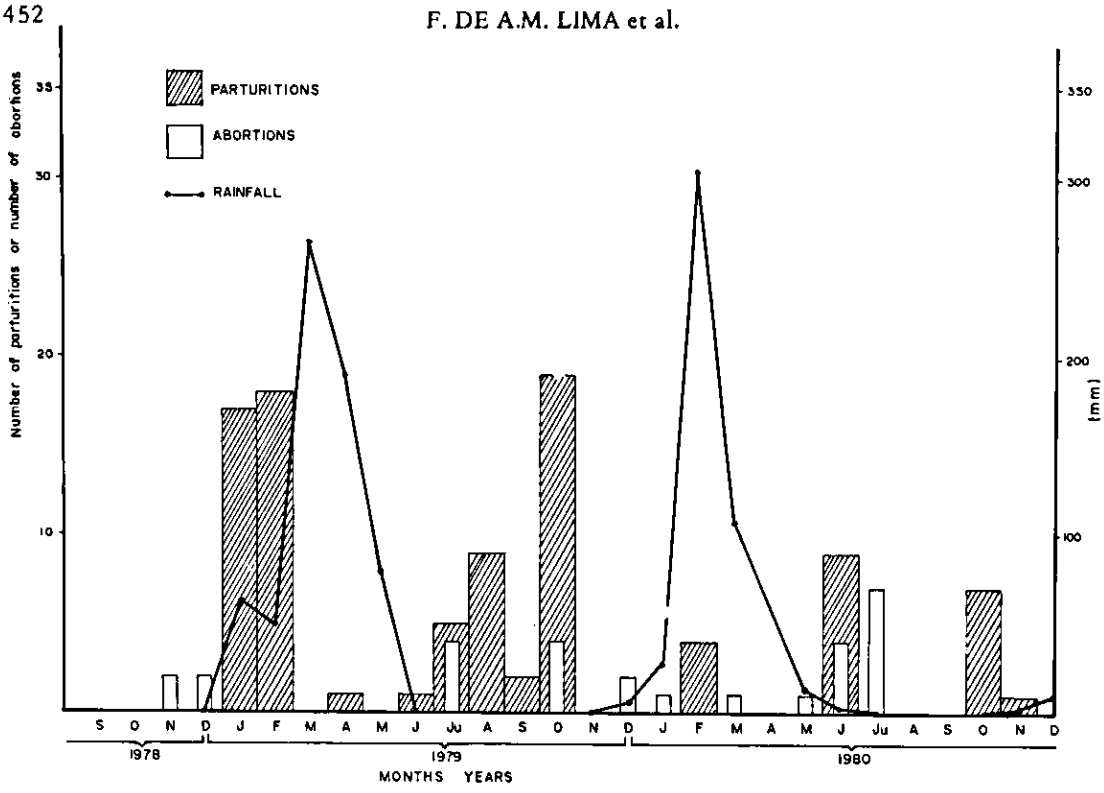

FIG. 2. Distribution of parturitions and abortions in relation to rainfall pattern.

kidded either singles or twins at the beginning of the open period and then aborted at the following kidding showed longer open periods than animals which successfully kidded in two consecutive kiddings, although the group of animals kidding twins and then singles or twins (TST), was not significantly different from the formers. A significant difference ($P < 0,05$) was found between the group of animals which kidded singles and then singles or twins (SST) and the group which firstly kidded twins and then aborted in the following kidding (TA).

Kids' mortality

The incidence of kid mortality according to age is presented in Table 5. The highest mortality rate (32.3%) occurred for the period between 7 and 112 days of age. Lower mortality rates occurred during the first week (18.8%) and post-weaning (20.5%) periods. However, when mortality rates were expressed per unit of time (% mortality/day), it was observed that highest incidence of mortality occurred during the first three days of life. The distribution of kid mortality with respect to sex and type of birth is presented in Table 6. It shows no clear cut advantage of males over females and of singles over twins. Overall kid mortality was rather high, reaching 76.4% mortality for the flock during the period of study.

The least-squares analysis of age at death of kids (Table 7) showed significant ($P < 0,05$) season and sex effects as well as season x sex interaction. Kids born in the rainy season and male kids survived longer than kids born in the dry season and female kids, respectively. Also, male kids born during the rainy season survived longer than either females born during the rainy season or males and females born during the dry season. Fig. 3 shows the distribution of kid and adult mortalities as related to the rainfall pattern throughout the period of study. It can be observed that the highest mortality occurred during the dry months (August-January) and that mortality is drastically reduced as soon as the amount of rainfall increases. Fig. 4 illustrates the relative advantage of kids born in the rainy season as opposed to the ones

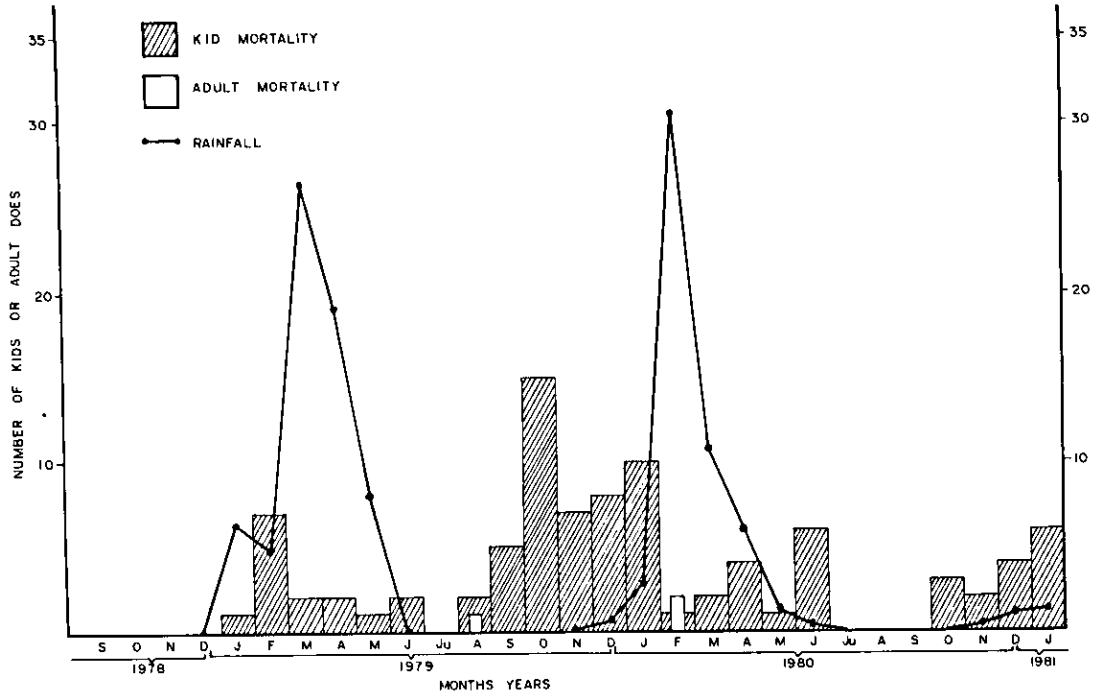

FIG. 3. Kids and adult does mortality distribution in relation to rainfall patern.

born in the dry season. A lower percentage of kids born during January and February 1979 (rainy season) died during the course of the experiment, than those born in any other month, when mortality rates by month ranked from 90% to 100%.

DISCUSSION

Under the climatic conditions of the geographical region and under the constraints imposed to this experiment in trying to imitate as much as possible the traditional system of management, the season effect has been the most important and significant one influencing all production parameters analysed (Lima et al. 1983, 1985).

Doe body weigth was highly correlated to rain pattern in as much as the onset of the rainy season dictated the triggering of an increase of edible vegetal material and this in turn triggered a weigth gaining phase. As the edible material decreased in quantity and quality, as a result of consumption and lack of rains, a weigth losing phase was imposed on the animals. In this way, the highest mean weight was reached around August, three months after the cessation of rains. The lowest mean weight occurred around January, at the onset of the rainy season. The diffeferece between the highest and the lowest mean weights was about 12 kg. Between August and Janaury, the animals showed a weight loss of about 80 g/day, while between February and August, the animals were regaining weight at a rate of 57 g/day. The weight oscillation should cause some fertility problems for the flock increasing number of abortion, service periods and corresponding kidding intervals.

The kidding pattern throughout the period of analysis is not regarded as a natural one, since bucks were introduced in a flock of dry animals at the beginning of the experiment and this may have stimulated does to go into estrus (Shelton 1960). Thus, 39 pregnancies started in September

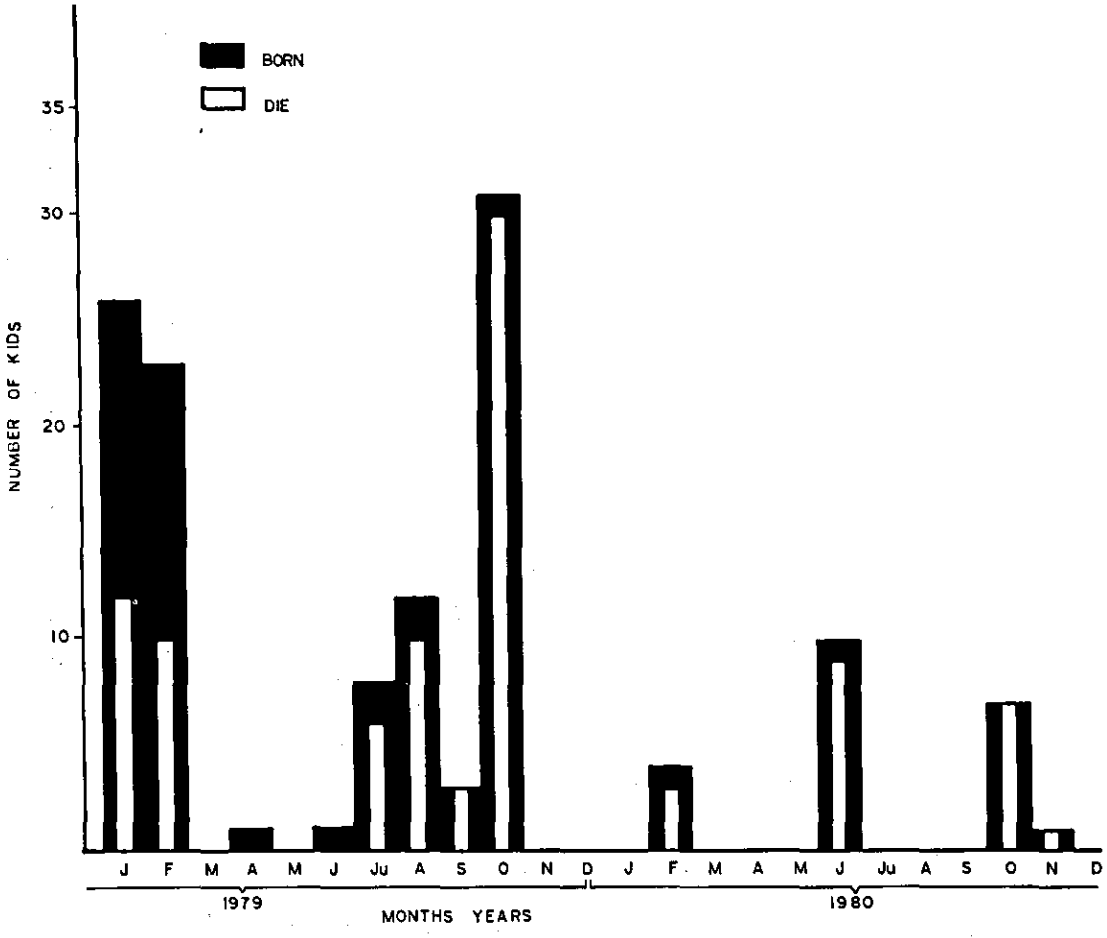

Figure 4. Number of kids born within month and number of those kids which die during the course of the experiment.

FIG. 4. Number of kids born within month and number of those kids which die during the course of the experiment.

TABLE 1. Analyses of variance of gestation length (days) and kidding interval (days) of SRD goats.

Source of variation	d.f.	Gestation length	Kidding interval
Type of birth	1	10.79 ns	7033.97 ns
Error	§	9.73	7626.55
		(43)	(28)

§ Degrees of freedom within parenthesis.

TABLE 2. Means of gestation length and kidding interval SRD goats.

Main effect	Classes	Gestation length (days)	Kidding interval (days)
Type of	Singles	146.11 (0.721) a	274.18 (22.72) a
of birth	Twins	145.11 (0.419) a	305.08 (21.65) a

Means with the same superscripts are not significantly different (P 0,05).

TABLE 3. Analyses of variance of service period (days) according to different criteria of classification of data[1].

Source of variation	Season and kidding status at the beginning of the service period		Season at the beginning of the service period and combination of kidding status at previous and kiddings	
	d.f.	MS	d.f.	MS
Season (S)	1	20454.84*	1	10738.38 ns
Kidding Status (K)	1	9235.20 ns	3	13072.19*
S x K	1	561.47 ns	3	1071.81 ns
Error	41	4205.47	37	3967.76

[1] Analyses of variance by the method of weighted means.

TABLE 4. Unweighted means of service period length (days) as affected by season and kidding status.

Main effects	Classes	Season and kidding status at the beginning of the service period	Season at the beginning of the service and combination of kidding status at previous and following kiddings
Season	Rainy	124.8 a	134.1 a
	Dry	170.4 b	170.0 a
Kidding Status	Single	132.3 c	–
	twin	162.9 c	–
	SST	–	180.7 b
	SA	–	174.7 bc
	TST	–	137.0 bc
	TA	–	187.8 c

Note: Comparisons were made within column and within main effects;
different superscripts show a significant difference (P 0,05);
SST: single to single or twins.
SA: singles to abortion.
TST: twin to single or twins.
TA: twin to abortion.

and October 1978 of which four resulted in abortions. The first kidding peak coincided with the onset of the rainy season, and the second peak occurred during the dry season, between August and October 1979.

TABLE 5. Kid mortality according to age.

Age of kids	Number of kids	Percentage of total mortality	Mortality percentage based on total number of kids born	Day (%)
0 - 24 (h) a	9	9.3	7.1	9.3
25 - 48 (h)	7	7.2	5.5	7.2
49 - 72 (h)	4	4.1	3.1	4.1
4 - 7 (d) b	4	4.1	3.1	1.4
7 - 112 (d)	41	42.3	32.3	0.4
112 (d)	26	26.8	20.5	–
N.I.	6	6.2	4.7	–

Note: a = hours.
b = days.
N.I. = Not identified.

TABLE 6. Kid mortality according to sex and type of birth.

Sex	Type of birth	Total born	Total deaths	Percent of mortality
Male	Single	28	22	78.6
	Twin	30	19	63.3
Female	Single	27	20	74.1
	Twin	34	27	79.4
–	Triplets	3	3	100.0
N.I.	–	5	6	–
Total	–	127	97	76.4

N.I. = Not identified.

It is expected for a doe to have at least one kidding per year unless reproductive problems exist. From the 50 does used in the experiment, only two did not kid during the period of the study and could be regarded as sterile ones. The remaining 48 does should have given at least 96 kiddings. Nevertheless, only 33(69%) animals kidded twice and 5(15%) of these, three times, within the period analyzed. Fifteen (31%) does out of the 48 fertile had only one kidding in two years, showing a clear reproductive inefficiency.

TABLE 7. Lest-squares analysis of variance and lest-squares means of age at death (days) of SRD kids.

Source of variation	d.f.	Mean squares	Least-square means	
			Classes	X̄ (s.e)
Season (E)	1	46683.59*	Rainy	139.6 (25.8) a
			Dry	80.0 (14.1) b
Sex (S)	1	54608.78*	Male	141.0 (18.5) c
			Female	78.7 (22.1) d
Type of birth	1	3682.66 ns	Single	102.1 (21.1) e
			Multiple	117.5 (18.6) e
			Rainy - males	199.8 (28.6) f
E x S	1	48656.73*	Rainy - females	79.5 (41.4) g
			Dry - males	82.2 (22.6) g
			Dry - females	77.8 (17.7) g
E x T	1	31.99 ns	—	—
Regression on birth weigth	1	35892.80 a	—	—
Error	80	11612.80	—	—

* (P 0,05).
a (P = 0,0826).
ns = non-significant.
Means with same superscript within main classification are not significantly different (P 0,05).

Feed was scarse during the dry season and animals may have had to survive on a low energy plan, which may have contributed for the high abortion rate. The effect of nutrition plan on reproductive efficiency had been demonstrated on does fed isonitrogenous diets containing low-energy levels (Sachdeva et al. 1973).

Gestation lenght and kidding interval were not influeced by type of birth nor kidding type, respectively. This is in agreement with the findings of Mishra et al (1979) for the Sirohi and Beetal, Gupta et al. (1964) for the Black-Bengal, Kirkpatrick & Akindele (1974) for the West African Dwarf breeds.

Gestation length is commonly influenced by breed, birth weight, nutritional plant (Jardim et al. 1965, Forbes 1967, Sachdeva et al. 1973, Gonzalez-Stagnaro 1977) and probably by type of birth, although there are some conflicting evidences for the latter effect. For sheep it has been reported that multiple births are associated with shorter gestations (Forbes 1967), while Glimp (1971) found that the gestation lenght of Suffolk, Targhee, Corriedale, Navajo and Coarse wool breeds was not influenced by type of birth.

Factors affecting open period in goats have not been thoroughly investigated. Although with small number of observations, this study was an attempt to do so. When data were classified according to season of kidding and kidding type at the beginning of the open period, season was found to significantly influence the open period. Does kidding during the rainy season showed shorter open periods than does kidding during the dry season, the season effect being correlated, most probably, with the nutritonal plane, as discussed earlier.

Season influence on open period disappeared when data were also classified according to the combination of kidding type, at the beginning of the open period, and at the following kidding.

The longest open period was found for does raising twins and aborting at the following gestations. The shortest open period was observed in does raising singles and then singles or twins at the following kidding. The trend observed was an ex-

pected one, even though the analysis was carried out with small number of observations. It appears that does kidding twins had a higher number of abortions in the following kidding. This could be related to nutritional plane as well. Animals which aborted in the following kidding were already having some reproductive problems to conceive, wich is reflected by relatively longer open periods. Proper attention to those animals might improve their output, mainly when one considers that about 23% of the conceptions resulted in abortions, jeopardizing the profitability of the enterprise.

The high mortality rate of kids (76.4%) was a striking observation which magnifies the inefficiency of the traditional management system as it was designed for this experiment. Whether the same mortality rates occur at producers' farms remains to be determined. In general, during the dry season, the producers supplement only those goats which are in the worst condition (Primov 1984). This strategy might reduce mortality rates at farm level. In the present study these husbandry practices were non existing and may partially explain our observation.

Mortality rates were highest during the dry season period (Fig. 3). Lower birth weights (Lima et al. 1983), competition for the scarse fodder with adult animals, and the fact that there are overlapping nursing ages, are some of the causes which might have contributed to the high mortali ty rate.

The highest mortality occurred between seven and 112 days of age (Table 5). Mortality rate was not influenced by sex or type of birth (Table 6). However, season, sex and their interaction had significant effects on the age at death of the SRD kids (Table 7). Kids born during the rainy season and males, survived longer than the ones born during the dry season and female kids, respectively. Also male kids born during the rainy season lived 100 days longer than any of the other classes analysed. Figueiredo & Pant (1982) also reported a significant sex difference, although in their case females survived longer. However, since birth weight is positively correlated with survival period (Figueiredo & Pant 1982) and males showed superior birth weights than females under the traditional system of management (Lima et al. 1983), it is reasonable to expect that in this study males should survive the longest on the average. High mortality rates during the preweaning period of about 31% have been reported for Red Sokoto (Adu et al. 1979), 24% for Ceylon Native (Ranatunga 1971) and 12.5% for the West African Dwarf (Osuagwuh & Alpokodje 1981) breeds.

In another study at a research station located in Petrolina, PE, Brazil, where comparisons among four goat production systems were carried out, the traditional system of management showed 32% of kid mortality. The other three improved production systems showed somewhat lower mortality levels, although a clear advantage over the traditional system could not be determined with regard to kid mortality (Padilha et al. 1980).

CONCLUSIONS

1. An inefficient reproductive performance of native SRD goats maintained under the traditional system of management as designed under experimental farm conditions, as well as a high rate of kid mortality, was found.

2. Some improvement of actual levels of productivity could be achieved by carrying out one breeding season per year, which could be set at any time between September and December depending upon the location of the farm and carefull historical survey of precipitation at the particular site. This would ensure that the breeding season could start within 100 to 120 days before the beginning of the rainy season.

3. This strategy will allow does to have enough fodder during the last third of the pregnancy, thus producing heavier kids which could grow faster and less prone to death. This approach will increase productivity by reducing kid mortality.

4. Other approaches such as crossbreeding of native animals with exotic ones to improve prolificacy, or the use of supplements at critical periods during the year, remain to be assessed.

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