TRADITIONAL SYSTEM OF GOAT MANAGEMENT

II. POSTWEANING GROWTH PERFORMANCE OF THE SRD (NONDESCRIPT) GOATS[1]

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ABSTRACT - The pattern of growth of SRD kids from an average of 153 days up to approximately 461 days of age was studied. Weights at the ages of 153 (W_5), 181 (W_6), 209 (W_7), 237 (W_8), 265 (W_9), 293 (W_{10}), 321 (W_{11}), 349 (W_{12}), 461 (W_{16}) days and calculated weight gains (G) between every weight interval G_5 = (W_5 - Weaning weight) through G_{12} = (W_{12} - W_{11}) were evaluated. Data were initially recorded on 54 kids and diminished thereafter at every interval due to kid mortality. The least squares analysis of variance showed a significant season of birth effect ($P < 0.05$) for all variables except W_{11}, W_{16}, G_7 and G_9. Animals born during the rainy season were heavier up to W_{10} and had higher gains up to G_7. An inversion of these trends was observed starting at W_{12} and G_8 respectively. Sex, type of birth and all interactions analyzed were non significant ($P > 0.05$) with the exception of type of birth for G_{12} ($P < 0.025$). The covariables of mother's weight at parturition and exact age of kids at the time of weighing were not always significant. However, the birth weight covariable was significant for W_7, W_8, W_{10}, ($P < 0.005$), W_9 ($P < 0.01$), W_6, W_{11} and G_{12} ($P < 0.025$).

Index terms: native breed, growth pattern, weight gain.

SISTEMA TRADICIONAL DE MANEJO DE CAPRINOS
II. DESEMPENHO DE CAPRINOS SRD NA FASE DE PÓS-ALEITAMENTO

RESUMO - Avaliou-se o crescimento de cabritos a partir dos 153 até aos 461 dias de idade. Foram estudados os pesos, às idades médias de 153 (P_5); 181 (P_6); 209 (P_7); 237 (P_8); 265 (P_9); 293 (P_{10}); 321 (P_{11}); 349 (P_{12}) e 461 (P_{16}) dias e os ganhos de pesos (G) calculados entre cada intervalo destas pesagens, G_5 a G_{12}. Os dados foram inicialmente obtidos de 54 cabritos e diminuíram para cada ganho de peso estudado, em virtude da mortalidade. As análises de variância foram feitas pelos Quadrados Mínimos e mostraram que o efeito da estação de nascimento foi significativo ($P < 0,05$) para todas as variáveis estudadas, com exceção de P_{11}; P_{16}; G_7 e G_9. Animais nascidos na estação chuvosa foram mais pesados até P_{10} e apresentaram maior ganho de peso até o G_7, entretanto, houve uma inversão a partir de P_{12} e G_8, respectivamente. Os efeitos de sexo e tipo de nascimento e todas as interações estudadas não tiveram efeitos significativos ($P > 0,05$), com exceção do tipo de nascimento para G_{12} ($P < 0,025$). As covariâncias de peso da mãe ao parto e idade do cabrito no momento da pesagem, foram significativas em algumas idades. Já para peso ao nascer, a covariável foi significativa para P_7, P_8, P_{10} ($P < 0,005$); P_9 ($P < 0,001$); P_6, P_{11} e G_{12} ($P < 0,025$).

Termos para indexação: padrões de crescimento, raça nativa, ganhos de peso.

INTRODUCTION

The underlying problems of small producers and the importance of goats for the Northeast of Brazil have been very well documented (Gutierrez et al. 1981, Gutierrez & DeBoer s.n.t., Primov 1982). In general, technological innovations at the small producer's level are of very slow implementation and will depend heavily on the economic importance of the activity within the overall system of production, within every farm. Also costs and availability of financial resources will ultimately determine its pace (French 1970). Therefore, an evaluation of the traditional system of goat management was necessary to determine the advantages and/or disadvantages of such a system under the harsh climatological conditions of this geographical region, and, to some extent, to allow to suggest modifications of the management system without implying capital investment, which at the small producer's level is rather scarce or nonexistent.

MATERIAL AND METHODS

The Centro Nacional de Pesquisa de Caprinos (CNPC)-EMBRAPA is located in Sobral, Ceará, Brazil. Climatolo-

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gical data of the area have been reported elsewhere (Figueiredo & Pant 1982, Lima et al. 1983).

One hundred and twenty kids from the SRD (without racial definition) type were used. A description of the management system has been reported by Lima et al. (1983). Weaning was allowed to occur naturally. Kids remained with their mothers during the whole period of evaluation.

Weights were recorded every 28 days on a fixed day. Weights at an average of 153 (W_5), 181 (W_6), 209 (W_7), 237 (W_8), 265 (W_9), 293 (W_{10}), 321 (W_{11}), 349 (W_{12}), 461 (W_{16}) days of age and calculated weight gains for every 28 day interval between weaning weight (125 days of age) and W_5 (G_5), W_5 and W_6 (G_6), W_6 and W_7 (G_7), W_7 and W_8 (G_8), W_8 and W_9 (G_9), W_9 and W_{10} (G_{10}), W_{10} and W_{11} (G_{11}), W_{11} and W_{12} (G_{12}), were analysed.

The general linear model procedure of least squares analysis of variance (Barr et al. 1979) was used for analysis according to the following models:

Y = W_5 through W_8 and G_5 through G_8;

$$Y_{ijkl} = \mu + P_i + S_j + T_k + PS_{ij} + PT_{ik} + ST_{jk} + PST_{ijk} + b\,(BW_{ijkl} - \overline{BW}) + b'\,(MW_{ijkl} - \overline{MW}) + b''\,(ND_{ijkl} - \overline{ND}) + E_{ijkl};$$

Y = W_9 through W_{12} and G_9 through G_{12};

$$Y_{ikl} = \mu + P_i + T_k + PT_{ik} + b\,(BW_{ikl} - \overline{BW}) + b'\,(MW_{ikl} - \overline{MW}) + b''\,(ND_{ikl} - \overline{ND}) + E_{ikl}$$

where:

Y_{ijkl} = is the value of the dependent variable of the l th kid, born in the ith season, with the jth sex in the kth type of birth.

Y_{ikl} = is the value of the dependent variable of the l th kid, born in the ith season, with the kth type of birth.

μ = overall population mean which is common to all observations.

P_i = effect of the ith season of birth (i = 1, 2).

S_j = effect of the jth sex (j = 1, 2).

T_k = effect of the kth type of birth (k = 1,2).

PS_{ij} = interaction between the ith season with the jth sex (ij = 1, 2, 3, 4).

PT_{ik} = interaction between the ith season with the kth type of birth (ik = 1, 2, 3, 4).

ST_{jk} = interaction between the jth sex with the kth type of birth (jk = 1, 2, 3, 4).

PST_{ijk} = interaction between the ith season, jth sex and kth type of birth, (ijk = 1, 2, 3, 4, 5, 6, 7, 8).

$b\,(BW_{ijkl} - \overline{BW})$ = regression of the dependent variable on birth weight of kids.

$b'\,(MW_{ijkl} - \overline{MW})$ = regression of the dependent variable on mother's weight at parturition.

$b''\,(ND_{ijkl} - \overline{ND})$ = regression of the dependent variable on the exact number of days between day of birth and first weighment.

E_{ijkl} = random error assumed to be normally and independently distributed with standard assumptions that make the analysis valid.

A separate model for the W_9 through W_{12} and G_9 through G_{12}, not including the season effect (P_i), was used to test the effect of sex (S_j). Since sex did not show to be a significant effect and total number of observations did not allow its analysis in conjunction with the season effect, sex effect was not considered further in the final model used for analysis of the dependent variables mentioned above.

RESULTS

Results presented were obtained from kids surviving from weaning up to 461 days of age. Hence, number of observations diminished at every time interval due to mortality.

Since the growth pattern of kids will depend on the maternal ability during the pre-weaning period with dependence on the genetic make up of the animal during the post-weaning period (Singh & Singh 1974), an arbitrary cut off point at approximately 125 days of age was necessary to differentiate both periods. However, weaning was allowed to occur naturally, thus kids continued to nurse their mothers for a longer period than it is recommended under improved management conditions (Sistemas de produção . . . 1980).

Results of the analysis of variance for weighments W_5 through W_{16} are presented in Table 1; and their corresponding least squares means, in Table 2. The analysis of variance for weight gains and their least squares means are presented in Tables 3 and 4, respectively. A graphic representation of average weights from birth up to 461 days of age with respect to season of birth is presented in Figure 1.

Main effects and interactions

The season of birth effect was significant ($P < 0.05$) for all weight variables analysed except for W_{11} and W_{16}. Animals born during the rainy season showed superior weights at every interval up to W_{10} than animals born during the dry season. Between W_{11} and W_{12}, an inversion of the

TABLE 1. Analysis of variance of body weights (kg) of SRD goats.

Source of variation	d.f.	Mean squares								
		W_5	W_6	W_7	W_8	W_9	W_{10}	W_{11}	W_{12}	W_{16}
Season	1	146.860****	246.047****	186.790****	119.416****	90.092****	19.399*	3.581	22.277**	23.769
Sex	1	6.477	1.861	0.892	9.648	-	-	-	-	-
Type of birth	1	8.473	1.008	2.106	4.019	7.408	1.053	0.036	8.667	0.012
Season x Sex	1	4.384	3.019	17.324	24.358	-	-	-	-	-
Season x Type	1	0.562	6.431	0.022	1.272	0.097	0.144	2.916	1.279	1.805
Sex x Type	1	1.475	0.058	1.992	1.319	-	-	-	-	-
Season x Sex x Type	1	3.651	0.498	0.127	2.824	-	-	-	-	-
Regression on mother's weight	1	1.800	0.042	0.260	0.485	0.625	5.536	12.871	36.375****	7.868
Regression on exact age	1	5.159	17.564	17.691	22.121	42.599**	32.341***	27.018**	6.313	0.149
Regression on birth weight	1	9.096	32.204**	54.437****	62.713****	56.363***	43.637****	19.090**	2.174	9.815
Residue	§	3.584 (43)	4.823 (41)	5.763 (34)	6.276 (33)	6.304 (34)	4.201 (30)	3.574 (27)	3.579 (26)	6.289 (18)

W_5 = Body weight at an average 153 days of age.
W_6 = Body weight at an average 181 days of age.
W_7 = Body weight at an average 209 days of age.
W_8 = Body weight at an average 237 days of age.
W_9 = Body weight at an average 265 days of age.
W_{10} = Body weight at an average 293 days of age.
W_{11} = Body weight at an average 321 days of age.
W_{12} = Body weight at an average 349 days of age.
W_{16} = Body weight at an average 461 days of age.
§ = Residue degrees of freedom within parenthesis within each column.

* $(0.025 < P < 0.050)$
** $(0.010 < P < 0.025)$
*** $(0.005 < P < 0.010)$
**** $(P < 0.005)$

TABLE 2. Least squares means of body weight (kg) of SRD goats.

Main effects	Classes	W_5	W_6	W_7	W_8	W_9	W_{10}	W_{11}	W_{12}	W_{16}
μ	-	11.093	12.694	13.702	14.068	14.865	14.605	14.674	13.152	16.388
Season	Rainy	12.28 (0.370)^a	14.26 (0.427)^a	14.75 (0.463)^a	14.92 (0.482)^a	15.59 (0.439)^a	14.93 (0.379)^a	14.91 (0.382)^a	12.97 (0.397)^a	16.85 (0.584)^a
	Dry	8.08 (0.498)^b	8.59 (0.623)^b	9.09 (0.845)^b	10.31 (0.907)^b	11.28 (1.023)^b	12.82 (0.879)^b	14.00 (0.799)^a	15.25 (0.796)^b	12.64 (2.057)^a
Sex	Male	10.57 (0.373)^c	11.65 (0.433)^c	11.74 (0.593)^c	11.99 (0.651)^c	-	-	-	-	-
	Female	9.78 (0.452)^c	11.20 (0.572)^c	12.10 (0.722)^c	13.24 (0.757)^c	-	-	-	-	-
Type of birth	Simple	10.72 (0.409)^d	11.61 (0.481)^d	11.58 (0.723)^d	12.14 (0.752)^d	12.75 (0.753)^c	13.59 (0.711)^c	14.51 (0.694)^b	14.97 (0.706)^c	14.70 (1.546)^b
	Multiple	9.63 (0.503)^d	11.23 (0.610)^d	12.26 (0.739)^d	13.09 (0.804)^d	14.12 (0.907)^c	14.16 (0.773)^c	14.40 (0.703)^b	13.25 (0.696)^c	14.79 (1.471)^b

Note: Figures within parenthesis indicate the standard error of the mean.
Comparisons are made within columns and within mains effects.

TABLE 3. Analysis of variance of weight gains (kg) of SRD goats.

Source of variation	d.f.	Mean squares							
		G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}
Season	1	9.191****	22.272****	0.067	7.585***	1.956	13.527****	8.072****	42.929****
Sex	1	0.003	0.091	0.352	3.520	-	-	-	-
Type of birth	1	2.650	2.808	3.063	0.719	0.999	0.238	0.325	7.869**
Season x Sex	1	2.037	0.683	0.002	0.347	-	-	-	-
Season x Type	1	0.010	2.645	2.657	0.649	2.147	0.965	1.083	0.258
Sex x Type	1	0.007	0.363	0.058	0.000	-	-	-	-
Season x Sex x Type	1	0.276	0.639	0.765	2.672	-	-	-	-
Regression on mother's weight	1	0.408	0.358	0.781	0.273	3.422*	0.003	0.634	5.909*
Regression on exact age	1	0.181	4.944	0.845	0.071	3.691*	0.577	1.481	7.169**
Regression on birth weight	1	1.755	4.456	0.784	0.168	1.223	0.030	1.618	8.544**
Residue	§	0.542 (43)	0.890 (41)	1.069 (34)	0.931 (33)	0.766 (34)	0.752 (30)	0.551 (27)	1.151 (26)

G_5 = Weight gain from 125 to 153 days of age.
G_6 = Weight gain from 153 to 181 days of age.
G_7 = Weight gain from 181 to 209 days of age.
G_8 = Weight gain from 209 to 237 days of age.
G_9 = Weight gain from 237 to 265 days of age.
G_{10} = Weight gain from 265 to 293 days of age.
G_{11} = Weight gain from 293 to 321 days of age.
G_{12} = Weight gain from 321 to 349 days of age.
§ = Residue degrees of freedom within parenthesis within each column.

* $(0.025 < P < 0.050)$
** $(0.010 < P < 0.025)$
*** $(0.005 < P < 0.010)$
**** $(P < 0.005)$

TABLE 4. Least squares means of weight gains (kg) of SRD goats.

Main effects	Classes	G_5	G_6	G_7	G_8	G_9	G_{10}	G_{11}	G_{12}
μ	-	1.446	1.425	0.426	0.202	0.456	-0.067	-0.091	-1.518
Season	Rainy	1.73 (0.144)^{a}	1.97 (0.183)^{a}	0.36 (0.199)^{a}	0.09 (0.185)^{a}	0.36 (0.153)^{a}	-0.35 (0.160)^{a}	-0.26 (0.150)^{a}	-1.94 (0.225)^{a}
	Dry	0.68 (0.194)^{b}	0.27 (0.267)^{b}	0.25 (0.364)^{a}	1.25 (0.349)^{b}	0.99 (0.356)^{a}	1.41 (0.371)^{b}	1.10 (0.313)^{b}	1.22 (0.451)^{b}
Sex	Male	1.19 (0.145)^{c}	1.07 (0.186)^{c}	0.42 (0.255)^{b}	0.29 (0.250)^{c}	-	-	-	-
	Female	1.21 (0.176)^{c}	1.17 (0.246)^{c}	0.19 (0.311)^{b}	1.04 (0.291)^{c}	-	-	-	-
Type of birth	Simple	0.90 (0.159)^{d}	0.80 (0.206)^{d}	-0.10 (0.311)^{c}	0.46 (0.289)^{d}	0.43 (0.262)^{b}	0.39 (0.300)^{c}	0.58 (0.272)^{c}	0.46 (0.400)^{c}
	Multiple	1.51 (0.195)^{e}	1.44 (0.262)^{d}	0.72 (0.318)^{c}	0.87 (0.309)^{d}	0.93 (0.316)^{b}	0.67 (0.327)^{c}	0.26 (0.276)^{c}	-1.18 (0.395)^{d}

Note: Figures within parenthesis indicate the standard error of the means. Comparisons are made within columns and within mains effects.

trend started, and the season of birth effect became significant ($P < 0.01$) at W_{12}.

The sex, type of birth and all possible interactions analysed for weights W_5 through W_{16} did not show any significant ($P > 0.05$) effect.

The analysis of variance for weight gains showed a significant season of birth effect for G_5, G_6, G_{10}, G_{12} ($P < 0.005$) and G_8 ($P < 0.01$). Weight gains at G_5 and G_6 were superior for animals born during the rainy season than for animals born during the dry season. Weight gains were almost equal at G_7 and an inversion of the trend was observed starting at G_8 and maintained up to G_{12}. From G_{10} up to G_{12} animals born during the rainy season, were losing weight.

Sex, type of birth and interaction of main effects were not significant for any of the weight gain variables analysed, with the exception of the type of birth effect which showed significance ($P < 0.025$) for G_{12}.

Covariables

For the analysis of body weights and calculated weight gains at every 28 day intervals, the covariable of mother's weight at parturition was significant for W_{12} ($P < 0.005$), G_9 and G_{12} ($P < 0.05$). The covariable of exact age of kids expressed in days at the time of weighing was significant for W_{10} ($P < 0.01$), W_9, W_{11} and G_{12} ($P < 0.025$). Birth weight covariable showed the most consistent and significant ($P < 0.025$) associated effect with all weight dependent variables analysed. However, this covariable did not show any association with the weight gain variables except for G_{12}.

DISCUSSION

Differences in climatic conditions between the rainy and dry season which will determine food and water availability as well as ambient temperature differences are bound to be reflected on the growth performance of animals. According to Winchester (1964), ambient temperature will have an important effect on food and water intake and energy conversion. Hence, animals born during the rainy season are expected to grow faster due

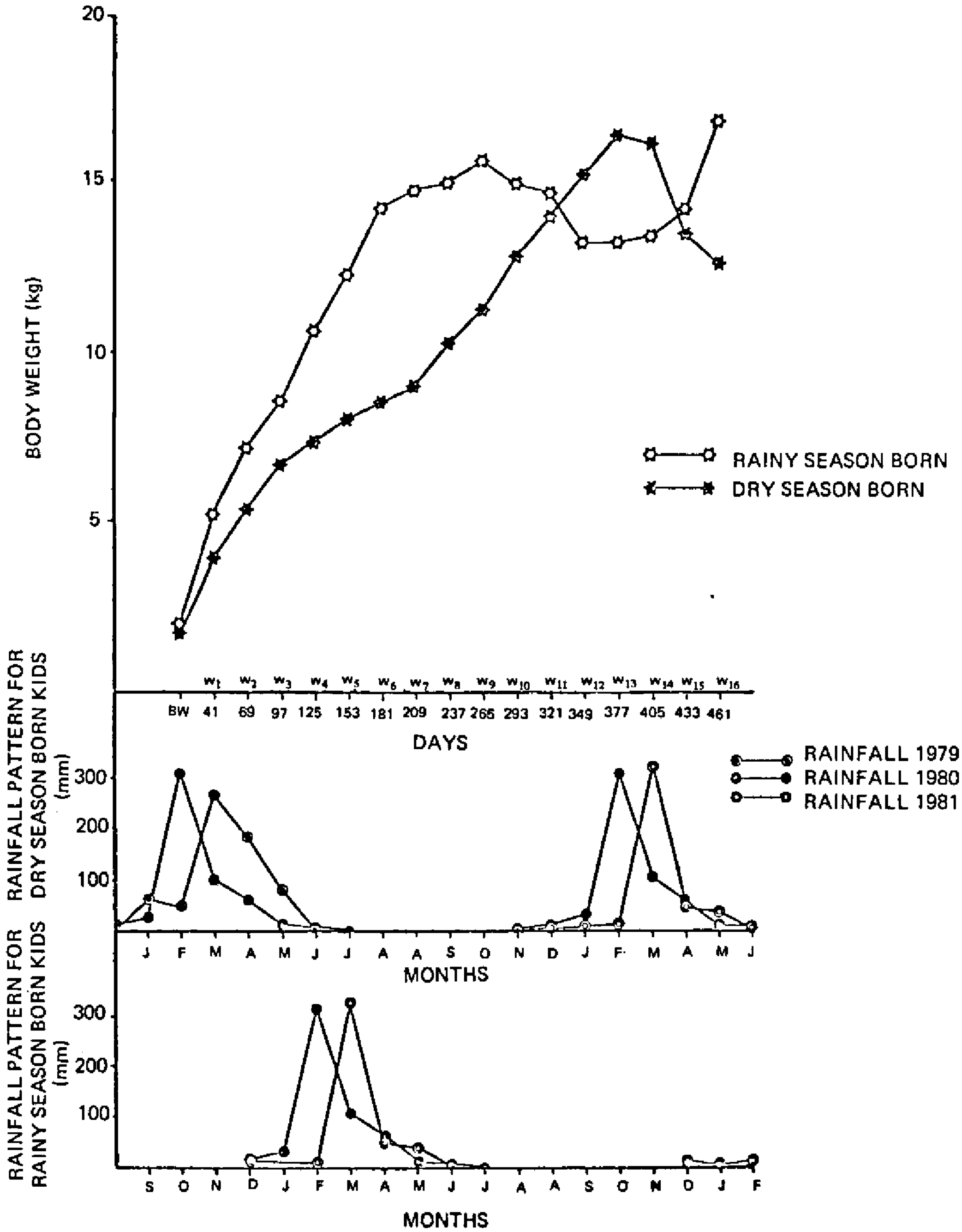

FIG. 1. The season of birth effect on the pattern of growth.

to abundance of feed available and even during the first month or so of the dry season because of the availability of leaf litter on the ground. However, the pattern of growth, as determined by weight gains, may slow down during the first half of the dry season until stopping, only to resume with the next rainy season. The opposite may occur for animals born during the dry season, presenting a slow pattern of growth during the first 6 to 7 months of age and increasing thereafter when they enter into their first rainy season, therefore compensating for their previous retarded development. Significant season effect on the pattern of growth of kids up to 17 weeks of age has been previously demonstrated for this region (Oliveira et al. 1982) and other subtropical and tropical regions as well (Guha et al. 1968, Arora & Acharya 1972, Ali et al. 1973, International Livestock Center for Africa 1979, Khan 1979, Sarma et al. 1981, Haryana Agricultural University 1982). However, for the Sirohi breed, in the Northwestern semi-arid region of India, Mishra et al. (s.n.t.) did not find any effect of the season of birth on body weights except for the weight at 9 months.

Lima et al. (1983) reported a significant sex and type of birth effect during the preweaning period of SRD kids, and stated that some indication of a compensatory growth for female kids and animals of multiple births was apparent at later stages during that period. At the postweaning period weight differences between males and females and between single and multiple born kids were non significant. The same pattern was observed for the weight gain variables analysed. The marginal advantage of weight gains for females and kids of multiple births at every weight gain interval was additive and narrowed down the differences of body weights observed during the preweaning period.

Our findings differ from those reported for the Jamnapari breed, where sex of kid was found to influence body weights from birth until 15 months of age (Khan 1979), as well as growth rates, except for the period between 4 to 8 months (Singh & Singh 1974). Similarly sex and type of birth were found to influence growth rates from birth up to one year of age, in the Black Bengal breed (Guha et al. 1968).

The lack of sex and type of birth significant effects during the postweaning period may be due to smaller number of animals available for analysis. However, under the agroclimatic condition of the Northeast of Brazil, the effect of environment, especially that due to nutritional stress during dry season may be so marked as to mask sex and type of birth effects. Perhaps a combination of several other factors was responsible for such observation. In any case, sex and type of birth do not seem to influence much the postweaning growth of kids under the traditional system of management in this area.

Sex and type of birth effects could perhaps be more obvious when concentration of births occur within a limited period within a particular season. Results reported by Bellaver & Nunes (1982) support to a certain extent the latter fact. Animals born at the beginning of the rainy season showed inferior birth weights than animals which were born at the beginning of the dry season.

The covariable of mother's weight at parturition and exact age of kids at time of weighment were not associated with weights and weights gains throughout the period analysed. These covariables seem to be important only up to the third month of age and could be ignored in future analysis for postweaning weights and weight gain variables. The covariable of birth weight of kids demonstrated high association with subsequent weights, but had no influence on weight gains.

The growth curve presented in Fig. 1, demonstrated the typical shape expected for this geographical region. It could be observed that animals born during the rainy season reached about 14.26 kg on the average by W_6 with a mean age of 181 days. The net gain during this period was about 79 g/day. From W_6 to W_9, they showed an increase of 1.33 kg of body weight with net gains of 16 g/day. This lower daily gain is due to the fact that this group of animals was passing through their first dry season period. From W_9 to W_{12} there was a net loss of 32 g/day of body weight. Weight gains resumed again during the period between W_{12} and W_{16} at a rate of

35 g/day. The highest average weight (16.85 kg) reached by this group of animals occurred at W_{16} at a mean age of 461 days. The net increase of body weight between W_6 and W_{16} was 2.59 kg, but animals needed, on the average, 280 days to reach this difference.

Following the same kind of analysis for animals born during the dry season it was observed that weight gains up to W_6 were accomplished at a rate of 47 g/day, a much slower growth than that observed for animals born during the rainy season, due to the fact of lack of fodder. However, for the periods between W_6 to W_9 and W_9 to W_{12} the net daily gains were 32 g/day and 47 g/day respectively. Animals born in the dry season reached their highest weight (16.40 kg) at a mean age of 377 days. A comparable weight to that reached by animals born in the rainy season at W_6 (181 days of age) was reached at W_{11} (321 days of age) by animals born during the dry season, therefore, demonstrating the greater advantage of kiddings during the rainy season.

Based on these findings, it appears that under the traditional system of management kidding during the dry season should be avoided. In this sense, results presented are in agreement with a previous recommendation (Sistemas de produção... 1980). However, in the event that producers are incapable of accepting such recommendation, it would be advisable to recommend culling of male kids between 293 to 349 days of age. For kids born during the rainy season, culling of male kids not selected for breeding purposes should be carried out at a mean age of 181 to 209 days. It seems that the marginal higher weight attained at W_9 might not be profitable to justify a longer permanence of this class of animals under farm conditions. This practice will improve the management of the flock allowing better use of food resources which are normally scarse during the dry season. Another advantage would be that of a better control of matings, since few bucks would be kept and the flock will mainly consist of does and yearling females. Even though, this recommendation fits the present situation at the level of farm management, it still faces the meat marketing system which is not presently adapted to channel the product properly if the recommended practice is applied (Gutierrez & DeBoer s.n.t.). An alternative solution could be the supplementation of animals with crop residues (Barros et al. s.n.t., s.n.t., Johnson et al. s.n.t.) to maintaine the weight of animals and have them ready when meat demand and prices are attractive to producers.

Another reason which traditionally supports a delay in culling is based on the better price which could be obtained for a prime quality skin. As stated by Bellaver et al. (1980), a prime quality skin can be produced when an animal reaches minimum live weight of 16.00 kg. This weight is highly correlated with the minimum weight of a skin to be graded as a prime quality one. A skin graded as first quality would represent 29% of the price of a living animal. However in another report (Gutierrez & DeBoer s.n.t.), it was found that the proportion of value of the skin to the live animal value ranges from 6% to 8%. This conflicting evidence might be the result of normal skin price fluctuations, and with Brazil being a price taker in the international market for sheep and goat skins, little can be done to correct the situation. This fact attached to the normal risk involved in allowing animals to go through a dry season period indicates that skin value might not be a good indicator to establish the right moment for culling. Instead, early culling, which will allow better food resources for the rest of the flock, in conjunction with an improvement of the meat marketing system, or food supplementation with crop residues, could significantly improve the present situation with little or no additional capital investment.

REFERENCES

ALI, S.Z.; HOQUE, M.M. & HASNATH, M.A. A study on the growth and reproductive performance of Black Bengal goats under farm conditions. Indian Vet. J., 50:438-40, 1973.

ARORA, C.L. & ACHARYA, R.M. Factors affecting growth carcass yield in Indian breeds of sheep and their crosses. Indian Vet. J., 49:578-84, 1972.

BARR, A.J.; GOODNIGHT, J.H.; SALL, J.P.; BLAIR, W.H. & CHILCO, D.M. SAS user's guide. Raleigh, SAS Institute, 1979. 493p.

BARROS, N.N.; JOHNSON, W.L.; OLIVEIRA, E.R. & ROBB, T.W. Desempenho de caprinos sem raça definida em confinamento no Nordeste do Brasil. In: REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE ZOOTECNIA, 19., Piracicaba, SP, 1982. Anais... s.n.t. p.274.

BARROS, N.N.; OLIVEIRA, E.R.; ROBB, T.W.; JOHNSON, W.L. & PANT, K.P. Efeito da adição do melaço sobre o consumo de rações por caprinos sem raça definida (SRD), em confinamento. In: REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE ZOOTECNIA, 20., Pelotas, RS, 1983. Anais... s.n.t.

BELLAVER, C. & NUNES, J.F. Manejo da amamentação e suas influências sobre cabritos e cabras. Pesq. agropec. bras., Brasília, 17(1):157-61, jan. 1982.

BELLAVER, C.; OLIVEIRA, E.R. & FIGUEIREDO, E.A.P. O peso como fator técnico-econômico da comercialização de peles caprinas e ovinas tropicais. Sobral, EMBRAPA-CNPC, 1980. (EMBRAPA-CNPC. Pesquisa em Andamento, 1).

FIGUEIREDO, E.A.P. & PANT, K.P. Evaluation of goat breeds in the tropical Northeast of Brazil. II. An analysis of age of death of kids. Pesq. agropec. bras., Brasília, 17(5):803-8, maio 1982.

FRENCH, M.H. Observations on the goat. Rome, FAO, 1970. 204p.

GUHA, H.; GUPTA, S.; MURKHERJEE, A.K.; MOULIK, S.K. & BHATTACHARYA, S. Some causes of variation in the growth rates of Black Bengal goats. Indian Vet. J.,33(3):269-78, 1968.

GUTIERREZ, N.F.; DEBOER, A.J. & ALVES, J.U. Interações de recursos e características econômicas dos criadores de ovinos e caprinos no sertão do Ceará, Nordeste do Brasil; resultados preliminares. Sobral, EMBRAPA-CNPC, 1981. 49p. (EMBRAPA-CNPC. Boletim de Pesquisa, 3).

GUTIERREZ, N.F. & DEBOER, J. Marketing and price formation for meat goats, hair sheep and their products in Ceará State, Northeast of Brazil. In: INTERNATIONAL CONFERENCE ON GOAT PRODUCTION AND DISEASE, 3., Tucson, EUA, 1982. Proceedings... s.n.t. p.50.

HARYANA AGRICULTURAL UNIVERSITY. College of Animal Sciences. Department of Animal Breeding. Evaluation of genetic potencial of some Indian breeds of goats. In: ________. Annual progress report - 1981/82. Hissar, 1982. p.60.

INTERNATIONAL LIVESTOCK CENTER FOR AFRICA. Systems Study. Small ruminant production in the humid tropics. Addis Abeba, ILCA, 1979. 122p.

JOHNSON, W.L.; BARROS, N.N.; OLIVEIRA, E.R. & HARYANTO, R. Relative acceptability of Napier grass and maize crop residues by Brazilian SRD goats. In: INTERNATIONAL CONFERENCE ON GOAT PRODUCTION AND DISEASE, 3., Tucson, EUA, 1982. Proceedings... s.n.t. p.512.

KHAN, B.V. Jamnapari goats; production performance. In: SUMMER INSTITUTE ON GOAT PRODUCTION. Mathura, ICAR, 1979. p.9-27.

LIMA, F.A.M.; FIGUEIREDO, E.A.P.; SIMPLÍCIO, A.A. & PONCE DE LEON, F.A. Traditional system of goat management. I. Pre-weaning growth performance of SRD (nondescript) goats. Pesq. agropec. bras., Brasília, 18(5):557-63, maio 1983.

MISHRA, R.K.; GAUR, D.; SINGH, D. & ACHARYA, R.M. Purebreed performance of Sirohi goats under range management in semi-arid region of India. In: INTERNATIONAL CONFERENCE ON GOAT PRODUCTION AND DISEASE, 3., Tucson, EUA, 1982. Proceedings... s.n.t. p.348.

OLIVEIRA, E.R.; LIMA, F.A.M. & PANT, K.P. Housing, pasture management and roughage supplementation on the pre-weaning growth of goats in the tropical Northeast of Brazil. Pesq. agropec. bras., Brasília, 17(9):1389-97, set. 1982.

PRIMOV, G. Small ruminant production in the Sertão of Ceará-Brazil; a sociological analysis. Columbia, Univ. of Missouri, 1982. 66p. (Publication, 6).

SARMA, H.K.; THAKURIA, K.; SARMAH, P.C.; BORAH, H.P.; MOHAN, M. & PANT, K.P. Note on growth of Assam local goats. Indian J. Anim. Sci., 51(6): 669-72, 1981.

SINGH, B.B. & SINGH, B.P. Performance of Jamnapari goats. Indian Vet. J., 51:326-36, 1974.

SISTEMAS de produção de ovinos e caprinos. Sobral, EMBRAPA/EMATER, 1980. 55p. (Circular, 70).

WINCHESTER, C.F. Symposium on growth environment and growth. J. Anim. Sci., 23(1):254-64, 1964.