
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

EFFECTS OF DIFFERENT GROWTH PATHS FROM 4 to 11 MONTHS OF AGE ON ROMNEY HOGGET OESTRUS AND SUBSEQUENT REPRODUCTION

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SUMMARY

The effects of four different growth paths from weaning till the end of the hogget oestrous season on the incidence of hogget oestrus and on two-tooth reproduction have been studied in 290 Romney sheep. The respective weights (kg) of the four groups (HH, HL, LH_1 and LH_2) at weaning (early December) were 20.1, 20.0, 20.0 and 19.9, at the cross-over (late March) were 30.3, 30.2, 21.3 and 21.2, and at the end of the hogget oestrous season (mid-July) were 36.4, 32.0, 32.0 and 31.0. The percentages of hoggets showing oestrous in the four groups were 92, 66, 30 and 14. Nutrition in both feeding periods affected the incidence of hogget oestrus ($P < 0.01$). In the L-treatments (but not H-), later birth date was related to a lower probability of showing oestrus. The percentage of ewes lambing multiples was higher ($P = 0.05$) in the H H group (21%) than in the other 3 groups (11%). Those ewes that showed hogget oestrus had a significantly greater proportion of ewes lambing and ewes lambing multiples, but some of the difference was associated with differences in pre-mating liveweight.

INTRODUCTION

A knowledge of the factors that affect hogget oestrus is essential if maximum lamb production from ewe hoggets is desired, and it may also help in selection for fertility (Ch'ang and Raeside, 1957). Moore *et al.* (1978) found that high growth rates from 4 to 11 months led to an increased incidence of hogget oestrus and increased number of lambs born at the 2-year-old lambing. This paper reports the effect of high and low growth rates from 4 to 7 months of age, and from then until 11 months, on hogget oestrus and 2-year-old reproduction.

METHODS

Romney ewe lambs (290) were stratified on liveweight and then randomly allocated to four groups (HH, HL, LH_1 and LH_2). For the early period (December 6 to March 29), target weights were 30 and 22 kg for the H- and L-groups, and for the late period (March 30 to July 19) were 40 and 32 kg for the HH and HL groups, respectively. Target weights for the LH_1 and LH_2 groups were also 32 kg, and these groups were grazed together except for 4 weeks (March 29—April 26), during which the LH_1 group was grown faster than the LH_2 group. After July 19 the HH group was grown at a slower rate than the other three. The object was to equalize the mean liveweights of all four groups, and this was achieved on December 6. Thereafter all sheep grazed together.

The sheep were grazed in paddocks of approximately 3 ha for periods averaging 1 week. Pre-grazing herbage mass (kg DM/ha) was estimated by double sampling using pasture cuts and visual assessment (Haydock and Shaw, 1975). The daily herbage allowances given to the various groups from 6/12/77 to 6/12/78 are detailed in Table 1. Liveweights were recorded regularly, as were hogget oestruses.

TABLE 1: HERBAGE ALLOWANCE (kg DM/ewe/day) FROM 6/12/77 TO 6/12/78

	Period			
	6/12/77–29/3/78	29/3–26/4/78	26/4–19/7/78	19/7–6/12/78
HH	15.6	17.4	17.0	13.8
HL	15.6	12.9	7.5	8.0
LH_1	6.9	28.3	9.7	8.0
LH_2	6.9	11.6	9.7	8.0

The ewes were joined with 1% harnessed fertile rams on March 1, 1979. Mating marks were recorded fortnightly during an 8-week mating period, and ovulation rates by endoscopy on three occasions — April 19, May 10 and May 22. The number of lambs born and reared by each ewe was recorded.

RESULTS

LIVEWEIGHT

The liveweight changes of the four growth rate treatments are shown in Fig. 1. There was a 9 kg difference between the H- and L-treatments at the end of the early period ($P < 0.01$). At the end of the late period the HL, LH_1 and LH_2 treatments, which did not differ, were 4 kg lighter than the HH treatment. There were no significant differences in liveweight on and after December 6, 1978. The mean post-mating liveweights (kg) of the HH, HL, LH_1 and LH_2 treatments were 44.6, 43.4, 44.1 and 43.2, and the corresponding pre-lambing liveweights 46.3, 45.9, 45.6 and 44.3.

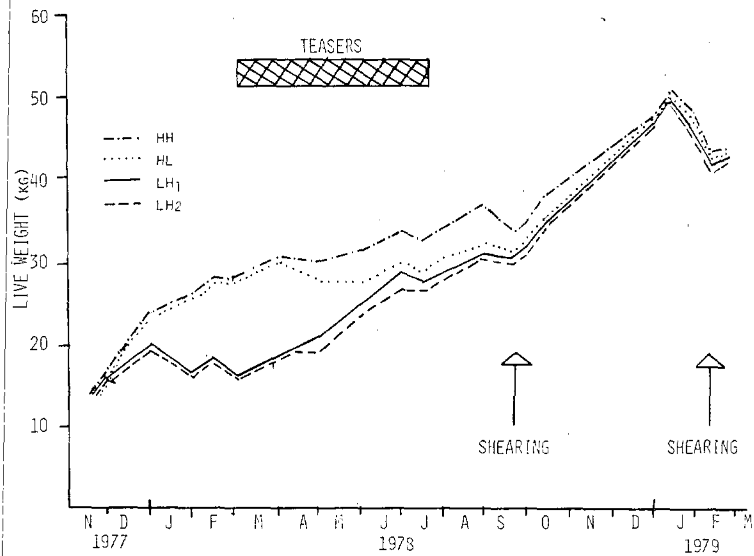

FIG. 1: *Liveweight changes from weaning until two-tooth mating.*

HOGGET OESTRUS

The hogget oestrus data are summarized in Table 2.

The incidence of hogget oestrus was analysed by a logit model (Nelder and Wedderburn, 1972), the dependent variable being ln $p/(1-p)$ where p is the proportion of ewes showing hogget oestrus. Independent variables were early growth rate, the late growth rate (nested within the early growth rate), and birth rank. Birth date and age of dam (2 to 7 years) were included as covariates. There was no effect of birth date on the incidence of oestrus in the H-treatments, but in the L-treatments the later the date of birth the lower the probability of showing oestrus. There was also a significant effect of dam age in the incidence of oestrus, ewes born from older dams showing a lower incidence. The groups that had high levels of early or late growth had a significantly higher incidence of oestrus ($P < 0.01$). Early growth rate had a significant effect on the incidence of oestrus over and above its effect through liveweight. For the H- and L-treatments the models were:

$$\text{H- } \log n\ p/(1-p) = -5.84 - 0.531\ (\text{age of dam}) + 0.725\ (\text{wt } 10/5) - 0.372\ (\text{wt } 29/3)$$

TABLE 2: INCIDENCE, WEIGHT, AGE AND DATE OF FIRST OESTRUS AND NUMBER OF HOGGET OESTRUSES IN THE FOUR NUTRITIONAL TREATMENTS

Group	*Number*	*Incidence of Hogget Oestrus (%)*	*Number of Oestruses/Hogget*	*Weight at First Oestrus (kg)*	*Age at First Oestrus (days)*
HH	78	92	3.0	32.7	255
HL	74	66	2.0	30.1	259
LH_1	73	30	1.7	29.0	266
LH_2	76	14	1.4	28.5	274

TABLE 3: TWO-TOOTH REPRODUCTION DATA

	Growth Rate Treatment				*Hogget Oestrus*	
	HH	*HL*	*LH_1*	*LH_2*	*Present*	*Absent*
Ewes joined	73	71	73	71	146	142
Ewes ovulating/ewes joined (%)	96	92	92	96	99	94
Ewes ovulating multiples/ewes ovulating (%)	26	19	15	18	22	17
Ewes present at lambing	73	70	66	69	145	133
Ewes lambing/ewes present (%)	73	79	77	68	77	71
Ewes lambing multiples/ewes lambing (%)	21	11	12	9	19	6
Lambs weaned/lamb born (%)						
Single lambs	91	88	87	95	67	83
Twin lambs	91	58	42	75	88	92
Lambs weaned/ewes joined	0.80	0.70	0.60	0.66	0.75	0.63

L- $\log n\ p/(1-p) = -8.61 - 0.531$ (age of dam + 0.725 (wt 10/5) $- 0.372$ (wt 29/3) $- 0.123$ (birth date $- 260$).

The two models are the same except for the different intercepts and the inclusion of birth date for the L-treatments.

The difference between the four growth treatments was found to be significant with respect to the number of hogget oestruses ($P < 0.01$) and the weight ($P < 0.01$) and age ($P < 0.01$) at first oestrus. A covariate (date of birth) was found to be significant for these three variates.

Two-tooth Reproduction

The two-tooth reproduction data (Table 3) were analysed by a model where the dependent variable was $\log n\ p/(1-p)$ where p is the proportion of ewes ovulating (EO/EJ), or of ewes ovulating multiples (EOM/EO), or of ewes lambing (EL/EP), or of ewes lambing multiples (ELM/EL); or of lambs surviving from birth to weaning (LW/LB). The independent variables were three main effects, early growth rate, late growth rate (nested within the early growth rate effect), the presence versus absence of hogget oestrus, and three covariates — liveweights on 29/3/78, 19/7/78 and 14/3/79 (pre-mating).

There were no effects of growth rate or hogget oestrus on EO/EJ or EOM/EO. However, for both variables there were significant effects of liveweight of 19/7/78. This weight was a better predictor of two-tooth ovulation rate than the pre-mating weight.

There were no effects of growth rate treatments on EL/EP, but the difference between the HH and the other three treatments with respect to ELM/EL was significant ($P = 0$). Those ewes that showed hogget oestrus had a greater EL/EP and ELM/EL, but these differences were partly associated with pre-mating liveweight differences since the probability changed from <0.05 to between 0.05 and 0.1 when pre-mating weight was included in the model. Pre-mating weight was a better predictor of EL/EP and ELM/EL than the weight of 19/7/78.

A t test indicated no effect of growth rate treatments or hogget oestrus on number of lambs weaned per ewe joined.

The HH treatment was significantly different ($P < 0.05$) from the other three treatments pooled with respect to LW/LB.

DISCUSSION

Growth rate is positively associated with the incidence of hogget oestrus, and at high growth rates oestrus occurs at a greater mean liveweight and at a younger mean age (Dyrmundsson, 1973). In this study it was also found that the late-born lambs had less chance of showing oestrus in the L-treatments but had the same chance in the H-treatments. This shows that time of birth and nutrition are the two most important factors influencing hogget oestrus, the former becoming important with low nutrition.

However, the difference in the incidence of oestrus between the H- and L-treatments could not be explained solely on the basis of liveweight changes. An H- ewe which weighed 26 kg at the end of the early period and gained 3 kg by 10/5/78 had a 90% chance of showing oestrus, whereas an L- ewe with similar total liveweight changes had only a 60% chance. It is evident that the physiological development of the L- animals was impaired. This is in agreement with the finding that poor nutrition over the same age span gave rise to a higher incidence of anovulatory oestrus (Moore and Bass, unpublished).

Previous studies (Wiggins, 1955; Hulet *et al.,* 1969; and Hight and Jury, 1976) have shown that ewes that show hogget oestrus produce more lambs, this effect being particularly marked at the two-tooth lambing. The effect of hogget oestrus in these studies could be attributed to either genetic or nutritional causes. Recently Moore *et al.* (1978) showed that nutritionally induced increases in the incidence of hogget oestrus were positively correlated with two-tooth fecundity; whether hogget oestrus was beneficial as such or whether the effects were due to the improved nutrition necessary to bring it about is unknown.

The failure in this study to achieve a clear effect of hogget oestrus on 2-year-old fecundity over and above the effect of pre-mating liveweight can probably be explained by the relatively low average ovulation rate (1.18). In the previous study where the ovulation rate was 1.26 (Moore *et al.,* 1978), ewes which showed hogget oestrus produced 0.17 more ovulations when the data were corrected for pre-mating weight.

ACKNOWLEDGEMENTS

Dr G. W. Winn for the statistical analyses, Dr T. W. Knight and P. R. Lynch for the endoscopy, and M. G. Pearce and W. A. Morgan for management and collection of data.

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