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EARLY PREDICTORS OF EWE FERTILITY

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SUMMARY

Two-tooth ovulation rate and hogget oestrus activity were measured on two flocks in 1975 and reproductive performance was recorded for surviving ewes in 1977-9. Twin ovulators were on average 2 kg heavier than single ovulators and hogget oestrous activity was positively related to May hogget weight. Weight differences diminished but did not disappear with time. Within both flocks a small but positive phenotypic relationship existed between early indicators of increased fertility and subsequent mature reproductive performance.

INTRODUCTION

The importance of increasing the reproductive performance of the national ewe flock is widely recognised and has been the focus of much of research examining environmental factors, which tend to be of a temporary nature (e.g. flushing and management stress) and more permanent changes (e.g. selection and crossbreeding). The trial reported here examined the phenotypic relationship between measures on young ewes and their mature reproductive performance, to assess the value of such measures as selection criteria.

EXPERIMENTAL DESIGN

SELECTION AND TREATMENT OF ANIMALS

In March 1975, 681 commercial two-tooth ewes (Flock A) were selected from 1200 in the Waikeria two-tooth flock on the basis of their displaying first seasonal oestrus over a 12-day period. Teaser-marked ewes were drafted off daily, weighed and ear tagged. A random half of these were then joined with fertile rams while the remainder were left unmated at that oestrus. All ewes in the unmated flock underwent laparotomy 3 to 5 days post-oestrus for ovulation rate (O.R.) measurement and were then joined with entire rams. Ewes from the mated flock which had not returned to service underwent laparotomy 30 to 35 days post mating for O.R. determination and pregnancy diagnosis.

A second group numbering 500 ewe hoggets (Flock B) was selected at random from a flock of 1600, individually identified, and joined with harnessed teaser rams in late April. All hoggets were weighed

the following week and thereafter those marked by teasers were drafted weekly and reweighed. During the peak of oestrous activity (late May - early June) 100 marked hoggets underwent laparotomy to measure O.R. All hoggets were again weighed when teasers were removed in mid-July.

SUBSEQUENT MANAGEMENT AND DATA COLLECTION

Flocks A and B were both joined with harnessed entire rams for mating in 1976. A portion of the Flock B animals were laparotomised 3 to 5 days post mating to measure O.R. in relation to the hogget oestrous activity of the previous year. Accurate lambing records were not collected until 1977 when all surviving identified ewes were used in continuing progeny test trials and lambing and liveweight data were collected for the following three years.

RESULTS

(a) FLOCK A — RELATIONSHIPS BETWEEN TWO-TOOTH OVULATION RATE AND OTHER TRAITS

The mean 1975 ovulation rate at first two-tooth oestrus for 559 ovulating ewes observed was 1.18. Mean liveweight at first oestrus was 2 kg heavier for twin than for single ovulators. The number of ewes remaining in the flock and their mean liveweights in February of subsequent years are shown in Table 1.

TABLE 1: MEAN LIVEWEIGHT (kg) FOR SINGLE-AND TWIN-OVULATING EWES — FLOCK A.

<i>Two-tooth O.R.</i>	<i>1975</i>		<i>1977</i>		<i>1978</i>		<i>1979</i>	
	<i>No.</i>	<i>Weight</i>	<i>No.</i>	<i>Weight</i>	<i>No.</i>	<i>Weight</i>	<i>No.</i>	<i>Weight</i>
1	458	41.7	292	58.4	265	53.6	246	56.1
			(64)*		(58)		(54)	
2	101	43.7	61	58.9	51	54.9	49	57.9
			(60)		(51)		(49)	

*% of ewes present relative to 1975.

Twin ovulators maintained a heavier mean weight over subsequent years although the differential was consistently smaller than at the two-tooth stage. A slightly smaller proportion of twin ovulators was present at the later lambings.

Mature reproductive performance of single-v twin-ovulating two-tooth ewes is shown in Table 2. Litter size was equivalent or

higher for the twin-ovulating group in all years; however, it tended to have a slightly higher proportion of barren ewes so that the mean lambing percent over all years was identical for the two groups.

TABLE 2: MATURE LITTER SIZE AND LAMBING %
OF SINGLE-V TWIN-OVULATING EWES — FLOCK A

<i>Two-tooth O.R.</i>	1977		1978		1979	
	<i>LB/EL</i>	<i>LB/EP</i>	<i>LB/EL</i>	<i>LB/EP</i>	<i>LB/EL</i>	<i>LB/EP</i>
1	1.52	1.48	1.44	1.38	1.52	1.41
2	1.53	1.47	1.60	1.50	1.62	1.29

LB = Lambs born
EL = Ewes lambing
EP = Ewes present

FLOCK B — RELATIONSHIP BETWEEN HOGGET OESTRUS
AND OTHER TRAITS

In total, 59% of all hoggets were marked by teaser rams (Table 3). Increasing hogget weight was associated with an increase in oestrus activity, both in percent of hoggets cycling and in number of teaser matings per hogget cycling.

TABLE 3: HOGGET OESTRUS ACTIVITY RELATIVE TO MAY
LIVEWEIGHT (kg) FLOCK B

<i>Liveweight</i>	<i>No.</i>	<i>Proportion of hoggets Number of Cycles</i>				<i>% cycling</i>
		<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	
≤ 29	53	.68	.13	.13	.06	32
31	99	.58	.18	.13	.11	42
33	111	.46	.18	.22	.14	54
35	116	.31	.26	.25	.18	69
38	64	.23	.17	.36	.23	77
≥ 40	55	.18	.16	.20	.45	82
All	498	.41	.19	.21	.19	59

The mean liveweight for all hoggets was 34 kg increasing by 20 kg to maturity (Table 4). Mean hogget weights increased with increasing number of teaser matings and cycling hoggets averaged 2.4 kg heavier than non-cyclers. Ewes cycling as hoggets tended to remain heavier throughout their adult life (1977/9), although the differential was reduced.

TABLE 4: HOGGET AND MATURE LIVEWEIGHT (kg)
BY HOGGET OESTROUS ACTIVITY — FLOCK B

<i>Liveweight</i>	0	<i>Number of hogget cycles</i>				<i>All</i>
		1	2	3	4	
Hogget (1975)	32.8	34.4	35.0	35.7	37.2	34.2
Ewe (1977)	53.3	53.5	54.1	55.1	54.7	53.9
Ewe (1978)	52.0	51.9	53.6	54.2	53.4	52.7
Ewe (1979)	55.6	56.1	57.7	57.2	55.4	56.4

Among the 100 marked hoggets examined, 94 had ovulated — all with single ovulations. Ovulation rate was measured again on Flock B as two-tooths the following year. A sample of 156 ewes, chosen for having mated over a particular short period early in the season, produced a mean O.R. of 1.17 (essentially identical to the O.R. observed for two-tooths the previous year). Among the laparotomised two-tooths, those cycling as hoggets had a mean O.R. of 1.18 v 1.15 for those which had not cycled.

Litter size over the three successive years (1977/9) is shown in Table 5 for ewes present. Although an advantage was not seen in every year, the ewes which had shown hogget oestrus averaged .04 more lambs per ewe lambing (1.55 v 1.51) and those with three or more hogget matings averaged .10 more lambs than ewes not showing hogget oestrus. Ewes which had cycled as hoggets also had on average a slightly lower proportion of barren ewes (6.1 v 8.7%) over the three years.

TABLE 5: MEAN LITTER SIZE OF EWES BORN 1974 — FLOCK B

<i>Number of Hogget matings</i>	<i>Proportion</i>	<i>Lambing year</i>			<i>Mean</i>
		1977	1978	1979	
0	.41	1.49	1.53	1.50	1.51
1	.19	1.44	1.42	1.66	1.51
2	.21	1.47	1.55	1.52	1.51
3	.14	1.60	1.50	1.71	1.60
≥ 4	.05	1.67	1.53	1.76	1.65
≥ 1	.59	1.51	1.50	1.63	1.55

DISCUSSION

The results of this trial support the general hypothesis of several previous authors (Hight, Lang and Jury, 1978; Hight and Jury, 1976; McCall and Hight, in press; Moore and Smeaton, 1980) that

the incidence of hogget oestrus and multiple ovulations tend to be phenotypically associated with liveweight although considerable overlap in weight exists between ewes in different oestrous and ovulation classes.

Although differences in two-tooth ovulation rate, mature litter size and proportion of barren ewes were small, they were consistently in favour of ewes which had shown oestrus in their first autumn. The combined advantage in litter size and reduced barrenness resulted in an additional 7.7 lambs born/100 ewes mated, accruing to 23 additional lambs born/100 ewes over three lambings. Similarly, twin-ovulating two-tooth ewes from Flock A consistently displayed a higher mean litter size at older ages.

The magnitude of the difference in later reproduction between ewes of different hogget oestrus or early ovulation rate status is undoubtedly related to the mean flock performance (e.g. % of hoggets showing oestrus) and to subsequent nutritional reduction in early weight variation. Commercial flocks typically require retention of about 70% of potential replacements. Selection in Romney flocks of young ewes based on a single measure of ovulation would probably identify no more than 30% of the flock as multiple ovulators. Results of this trial suggest that additional selection on the basis of hogget oestrus activity would give a slight increase in mature reproductive performance, consistent with the findings of Hulet, Wiggins and Ercanbrack (1969) and Ch'ang and Rae (1972). Although earlier evidence suggested a moderately high genetic basis for this increased phenotypic performance, recent results (R. L. Baker and J. N. Clarke, unpublished) suggest the genetic correlation between hogget oestrus and later reproduction levels to be zero.

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