THE INFLUENCE OF SIRES ON LAMB SURVIVAL

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SUMMARY

Significant differences among sire groups were found in survival to weaning of multiple-born lambs in the Waihora Lands and Survey flock in 5 out of 7 years. Similar differences were observed in single-born lambs, but the number per sire was too small for the differences to be significant. The survival rates of the lambs were not related to their sires' selection index nor to components of this index (*i.e.*, dam's fertility index, ram's own weaning weight, hogget body weight and hogget fleece weight) except in 1977, when there was a relationship with hogget fleece weight.

Groups of rams, selected for high and low progeny survival on the basis of past performance, were single-sire mated to 120-125 randomly selected Romney ewes at Whatawhata in 1976 and 1977. There were no differences in 1976 between the two groups of rams in the survival of their progeny, but in 1977 lamb survival was 8% and 17% higher respectively for single- and twin-born lambs sired by the high progeny survival rams. The higher survival in single-born lambs was due to a lower incidence of dystocia, possibly caused by the lower birth weights and head circumferences of the high survival rate rams' progeny.

INTRODUCTION

The survival of lambs from the same breed of ewe can differ with the breed of the sire (Shelton, 1964; Carter *et al.*, 1974; Smith, 1977). There are, however, few published data on differences in lamb survival among sires of the same breed. McSporran *et al.* (1977) found differences among Romney rams in the incidence of dystocia in their progeny and attributed these to differences in the birth weight of the lambs.

The hypotheses that there are differences among sires in their progeny survival rate, and that groups of sires can be selected for high or low progeny survival, were tested in this study. An attempt was also made to relate the survival rate of a ram's progeny to its selection index and components of that index.

MATERIALS AND METHODS

EXPERIMENT 1

In each of the years 1972 to 1978, 20 rams were single-sire mated to a random selection of 70 to 100 high fertility Romney

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ewes at the Waihora Lands and Survey Block. Ewes were randomized to mating groups in index order within year of birth. The choice of the rams was based on a selection index calculated from the dam's lifetime fertility and the ram's own weaning weight, hogget body weight and hogget fleece weight. The dam's fertility index was computed from the sum of the deviations of the number of lambs weaned from the mean number of lambs weaned by each age group of ewes. The ram's selection index was updated as more information on its dam was accumulated.

At birth the lambs were tagged, their sex and birth rank recorded and dams identified. Lambs present at weaning were recorded.

The proportion of single- and multiple-born lambs surviving was calculated for each ram and the significance of the differences among rams was assessed using Chi square. The relationships of the ram's progeny survival rate with its selection index, components of the index and the proportion of the ewes lambing multiples per ewes lambing were determined by fitting models after logit transformation (Nelder, 1975).

Experiment 2

Three rams whose progeny had previously been found to have high survival (HS group) and three rams whose progeny had shown low survival (LS group) were each single-sire mated in 1976 to a random selection of 125 1½- and 2½-year-old Romney ewes at the Whatawhata Hill Country Research Station. This was repeated in 1977 using another selection of three high and three low progeny survival rams mated to a re-randomized selection of the same Romney ewes. Selection was based on the survival of the ram's progeny expressed as a deviation from the mean lamb survival for the flock in that year. In 1976, two of the LS rams were from Waihora and the other from Whatawhata, while in 1977 they were all from Whatawhata. All the HS rams were from Waihora.

Lambs were identified at birth and their dams recorded. The lamb's birth weight and the head and chest circumferences were recorded, together with the sex and birth rank. Ewes requiring assistance at lambing were recorded. Lambs present at weaning were identified.

The criteria of McFarlane (1965) were used in classifying causes of death in all carcasses. The lambs in the misadventure category include lambs dying of exposure without starvation and

lambs found dead in swamps and underground holes. The undiagnosed lambs consisted of lambs which were not present at docking and/or weaning but for which no carcass had been found.

The survival rate for single- and twin-born lambs and the incidence of assisted births and causes of lamb mortality were analysed by Chi-square procedures. Birth weights and chest and head circumferences were analysed by least square.

RESULTS

EXPERIMENT 1

Within-year differences among sires in the survival rate of their progeny varied from 19 to 30% in single-born lambs and 13 to 24% in multiple-born lambs (Table 1). The sire differences were not significant within singles, but greater numbers enabled significance to be reached within multiple-born lambs (1973 and 1975, $P<0.1$; 1976, 1977 and 1978, $P<0.01$). There were no significant correlations between survival of single- and multiple-born progeny of the sires.

TABLE 1: MEAN AND RANGE OF PROGENY SURVIVAL (%) AMONG SIRE GROUPS OF SINGLE- AND MULTIPLE-BORN LAMBS

	Single-born Lambs			*Multiple-born Lambs*		
Year	*Mean No. per Ram*	*Mean*	*Range*	*Mean No. per Ram*	*Mean*	*Range*
1972	16	85.4	26.7 n.s.	94	84.5	13.5 n.s.
1973	17	84.4	30.0 n.s.	65	78.0	23.8†
1974	36	90.7	19.4 n.s.	94	82.9	15.6 n.s.
1975	23	87.1	25.8 n.s.	95	81.5	18.0†
1976	22	85.5	29.4 n.s.	96	77.5	24.2**
1977	28	89.5	20.7 n.s.	85	81.4	20.9**
1978	42	90.3	20.6 n.s.	76	84.5	21.4**

There was a negative relationship between the survival of multiple-born lambs and the proportion of ewes lambing multiples to each sire (ELM/sire) in 1977 ($P<0.1$) and 1975 ($P<0.005$).

Survival rates were not related to the sire's selection index nor to any component of the index (*i.e.*, dam's fertility index, ram's own weaning weight, hogget body weight and hogget fleece weight), the exception being in 1977 when they were positively related ($P<0.05$) to the hogget fleece weight. There was a negative correlation ($P<0.1$) in 1977 between the ram's hogget fleece weight and ELM/sire.

EXPERIMENT 2

Pre-experimental data on lamb survival and the deviation from the mean lamb survival within flocks and years for each ram tested are presented in Table 2, together with the deviation from the mean lamb survival in the experimental year. The 4.6% difference in survival of single-born lambs between the HS and LS groups in 1976 was not significant. In 1977 the survival of both single- and twin-born lambs was higher ($P<0.01$) for the progeny of HS sires. There were no significant birth rank by group interactions or differences among rams within the groups. The relative lamb survivals were not consistent across birth ranks for individual rams (Table 2).

TABLE 2: LAMB SURVIVAL (%) FOR LS AND HS GROUPS AND RAMS WITHIN GROUPS IN 1976 AND 1977 AND THE PRE-EXPERIMENTAL DATA ON THE RAMS' PROGENY SURVIVAL RATES

	Experimental Period		*Pre-experimental Data*	
	Singles	*Twins*	*Devn (Year)*	*Survival*
1976				
Lambs born	470	80		
Mean survival	81.7	74.1		
Devn for HS rams				
1	—4.8	+ 9.2	+ 9.8 (1973)	89.4
2	+5.5	+ 0.9	+ 3.8 (1974)	89.0
3	+6.3	—14.1	+11.6 (1973)	91.2
HS mean	+2.3	— 1.3		
Devn for LS rams				
4	+0.8	— 2.7	— 6.7 (1973)	72.9
5	—4.2	+ 9.2	— 9.4 (1973)	70.2
6	—3.6	— 2.7	— 4.6 (1973)	71.4
LS mean	—2.3	+ 1.3		
1977				
Lambs born	435	156		
Mean survival	89.2	72.3		
Devn for HS rams				
1	+3.2	+16.1	+ 5.3 (1975)	87.8
2	+6.5	—12.3	+ 7.5 (1976)	86.4
3	+2.0	+21.0	+ 4.7 (1975)	87.4
HS mean	+3.9	+ 8.3		
Devn for LS rams				
4	+2.6	+ 0.3	— 6.1 (1976)	74.1
5	—9.2	— 7.0	—10.1 (1976)	71.4
6	—5.9	—18.2	—23.2 (1976)	52.0
LS mean	—4.2	— 8.3		

TABLE 3: POOLED RESULTS OF THE POST-MORTEM EXAMINATIONS

	Single-born		*Twin-born*	
	HS	*LS*	*HS*	*LS*
Causes of lamb deaths as % lambs born:				
Pre-natal death	0.7	1.1	2.8	2.3
Dystocia	4.8	8.3*	2.8	0.8
Starvation/exposure	2.4	2.0	2.8	6.2
Infection	0.7	1.6	1.0	1.5
Dysplasia	0.0	0.0	0.0	0.8
Misadventure	1.1	0.4	1.9	3.8
Undiagnosed	2.2	4.0	6.6	16.2*

* $P<0.05$. All other HS : LS differences are not significant.

The HS groups had a lower percentage of single-born lambs diagnosed as dying of dystocia ($\chi^2_1 = 4.00$, $P<0.05$) and a lower percentage of twin-born lambs assumed dead although no carcass was found ($\chi^2_1 = 4.22$, $P<0.05$) (Table 3). All other causes of lamb death were similar in the two groups.

The percentage of ewes assisted at birth in the HS and LS groups was 9.9 and 13.4%, respectively, in 1976 ($\chi^2_1 = 1.45$, $P<0.1$) and 4.3 and 10.5% in 1977 ($\chi^2_1 = 6.48$, $P<0.05$). The difference in 1977 was largely due to ram No. 6, which had

TABLE 4: THE MEAN (± SE) BIRTH WEIGHT AND HEAD AND CHEST CIRCUMFERENCES OF LAMBS BORN IN 1977 TO THE RAMS OF THE HS AND LS GROUPS

	Birth Wt (kg)	*Head Circumference (cm)*	*Chest Circumference (cm)*
HS rams:			
1	3.7 ± 0.1	24.8 ± 0.2	34.0 ± 0.3
2	3.7 ± 0.1	24.8 ± 0.2	34.1 ± 0.3
3	3.8 ± 0.1	25.1 ± 0.2	34.7 ± 0.3
HS mean	3.7	24.9	34.3
LS rams:			
4	3.8 ± 0.1	25.0 ± 0.2	34.5 ± 0.3
5	3.7 ± 0.1	24.8 ± 0.2	34.2 ± 0.3
6	4.2 ± 0.1	26.1 ± 0.2	34.9 ± 0.3
LS mean	3.9	25.3	34.5
Significance:			
Between sire groups	*	**	n.s.
Within sire groups	***	***	n.s.
Regression on birth day	0.02 ***	0.04 ***	0.06 ***

20.4% of the ewes mated to it being assisted at birth. This ram had 11.5% of single-born lambs dying of dystocia.

In 1976 there were no differences between groups or among rams within groups for the birth weight and head and chest circumferences. For the 1977 data the regressions of birth weight and head and chest circumferences on birth date were all significant ($P<0.001$), and the values of these variates have been corrected for birth date in the least-squares analysis (Table 4). Mean birth weight and head circumference were higher ($P<0.05$, $P<0.01$) for the lambs sired by the low progeny survival rams, but there were no differences in chest circumference. 8here were differences ($P<0.001$) among rams within groups for birth weight and head circumference, but this was mainly due to the higher values for lambs sired by ram No. 6 (Table 4).

DISCUSSION

It has been shown that survival of lambs until weaning could be improved if rams were progeny tested for this trait. The survival rate of progeny could not be predicted from a ram's selection index nor components of that selection index. To date there is no explanation why the rams that sire more multiple-born lambs have a lower survival of those lambs.

The results for individual rams in Experiment 2 suggest that some rams may have a high survival of singles but not of twins. This is supported by the lack of correlation between the survival of single- and multiple-born lambs in Experiment 1.

More ewes mated to LS sires had assisted births, and the single-born lambs had a higher incidence of death from dystocia. This was possibly associated with the lambs having a higher birth weight and head circumference, and was especially evident for ram No. 6 in 1977. Dystocia may be caused by the lambs being too large relative to the birth canal of the ewe (Quinlivan, 1971; McSporran, 1975). The size of the lamb is determined by the genotype of the sire and dam and the intra-uterine environment, while the size of birth canal is determined by the dam (Dickinson *et al.*, 1962). Thus sires which produce lambs with a low incidence of dystocia in one strain of ewes may produce lambs with a high incidence when mated to ewes with smaller body frame and birth canal.

The large proportion of undiagnosed twin-born lambs means that the post-mortem examinations on these lambs must be interpreted with caution. These undiagnosed dead lambs would

have been picked up dead at tagging if they were pre-natal deaths or deaths from dystocia. It is likely these lambs died of starvation-exposure or infection. Hight and Jury (1970) found that starvation-exposure was the major cause of death in twin-born lambs. Haughey (1973) found that a large proportion of the carcasses of lambs diagnosed as dying of starvation-exposure had haemorrhages in the brain and/or spinal cord, probably caused by difficult birth or anoxia. Thus the influence of the sire on survival in both single- and twin-born lambs could be through its effect on lamb size and the resulting incidence of difficult births and dystocia.

Further trials are planned to investigate the influence of Romney sire and dam genotypes and their interaction on lamb survival rate.

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