ASPECTS OF LAMBING AND NEONATAL BEHAVIOUR OF DUAL-PURPOSE SHEEP

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SUMMARY
Parturition and neonatal behaviour data of Dormer and SA Mutton Merino lambs were recorded during 1992–1996. Single and first-born multiple SA Mutton Merino lambs were heavier ($P < 0.05$) at birth, and had longer ($P < 0.01$) parturitions. Dormer lambs were less ($P < 0.05$) likely to die during or shortly after birth than SA Mutton Merinos (0.035 vs 0.067; $Chi^2 = 6.14$). Relative to the total phenotypic variation, the magnitude of direct additive effects ($h^2 \pm SE$) was of the same magnitude as that of maternal permanent environmental effects (c^2) for birth weight (0.22 ± 0.09 and 0.19 ± 0.04 respectively). Direct additive effects were relatively unimportant for length of parturition (0.02 ± 0.04) but c^2 effects were important (0.17 ± 0.03). Dormer lambs were respectively 22 and 40% slower ($P < 0.01$) to progress from birth to standing and from standing to apparently suckling than SA Mutton Merinos. Post partum deaths within 3 days of birth was more ($P = 0.06$) prevalent in Dormer lambs than in SA Mutton Merinos (0.042 vs 0.022; $Chi^2 = 3.52$). The time lapse from birth to first standing was equally influenced by h^2 and c^2 effects (0.10 ± 0.05 and 0.09 ± 0.04 respectively). In the case of the period from standing to first suckling, h^2 effects were less important than c^2 effects (0.07 ± 0.04 and 0.19 ± 0.04 respectively). The c^2 effects are probably related to maternal behaviour in the neonatal phase, and will include intensive and persistent grooming of the neonate, co-operation with its first suckling attempts, the absence of aggression and aspects like teat placement and size. A better understanding of the inheritance of behaviour traits conducive to lamb survival will assist in the formulation of a sound breeding strategy for sheep.
Keywords: Parturition, neonatal progress, variance estimation, sheep.

INTRODUCTION
Alexander (1988) listed a number of behavioural attributes that contribute to the successful rearing of lambs to weaning. Patterns conducive to perinatal survival includes ease of birth in the ewe. Standing soon after birth, and suckling soon after standing, are important in lambs. Length of parturition was found to be shorter in Dormer than in SA Mutton Merino ewes, while it also was repeatable (Cloete 1992). Parturient deaths contributed to higher levels of lamb mortality in SA Mutton Merinos. Time lapses between birth and standing as well as between standing and suckling were heritable (Cloete 1993). These results were supported by significant breed variation in these traits (Slee and Springbett 1986). We thus investigated breed differences in these traits between Dormers and SA Mutton Merinos. DFREML procedures (Meyer 1991) were then used to partition genetic variances.

MATERIAL AND METHODS
Dormer and SA Mutton Merino lambs born at the Elsenburg ADI in March–April during 1992–1996 were used. These lambs and their dams were observed continuously by trained observers (Cloete

1992). Ewes were side-branded with stock marker spray to facilitate observations without disturbing to the flock. Length of parturition was defined as the time lapse between the first definite sign of birth in the ewe to the birth of the specific lamb. In multiples, the birth of the previous lamb was regarded as the beginning of parturition for subsequent litter mates. The periods of birth to first standing for > 10 s, and from standing to first apparently suckling were also recorded. Ewes experiencing difficult births were mostly assisted > 3.5 h after parturition started. Since ewes were assisted on the basis of time intervals, length of parturition was analysed for assisted singles and first-born multiples. In subsequent multiples, which were assisted when ewes failed to deliver a lamb within 2 h of the normal birth of the preceding lamb, the same reasoning applied.

Other recordings included pedigree information (identity of sire and dam), breed (Dormer or SA Mutton Merino), lambing year (1992–1996), sex (ram or ewe), age of dam (2–7 years) and order of birth (single, first lamb of multiples, subsequent lamb of multiples). Triplets were relatively few, and thus pooled with twins as multiples. Age specific lamb mortalities (parturient, ≤ 3 days post partum) were also available. Time lapses were $\log_{10}$ transformed before least squares analysis (Harvey 1990). Proportions were compared, using Chi^2 procedures (Siegel 1956). Several mixed models including direct additive genetic effects, maternal additive genetic effects, their covariation, as well as maternal permanent environmental effects were fitted to the data (Meyer 1991). The goodness of fit of these models was assessed, using log likelihood ratios. A model containing direct additive and maternal permanent environmental effects fitted the data best in all cases.

RESULTS AND DISCUSSION

Only significant ($P < 0.05$) effects were tabulated. Ram lambs were heavier ($P < 0.01$) with longer ($P < 0.01$) parturitions than ewe lambs (Table 1). Single born SA Mutton Merino lambs were 8.9% heavier ($P < 0.01$) than Dormer contemporaries. In first multiples this difference was reduced to 3.6% ($P < 0.05$), without a significant difference in subsequent multiples. The latter result was probably caused by more triplets in subsequent SA Mutton Merino multiples than in Dormers. Length of parturition of singles and first-born multiples was respectively 84 and 74% longer ($P \leq 0.01$) in SA Mutton Merino lambs than in Dormers. No difference was observed of subsequent multiples. This result could be attributed to 10 cases in 213 lambs (4.7% of cases) where only subsequent multiples of Dormer ewes were assisted. In SA Mutton Merinos, this was recorded only in 4 out of 351 lambs (1.1% of cases; $P = 0.018$; $Chi^2 = 5.53$). Dormer lambs were less ($P < 0.013$) likely to die during or shortly after birth than SA Mutton Merinos (0.035 vs 0.067; $Chi^2 = 6.14$).

Dormer lambs were respectively 21.5 and 40.4% slower ($P \leq 0.01$) to progress to standing and apparently suckling than SA Mutton Merinos (Table 2). The period from standing to apparently suckling was longer ($P < 0.05$) in subsequent multiples than in the other classes. Post partum deaths occurring within 3 days of birth were more ($P = 0.06$) prevalent in Dormer lambs than in SA Mutton Merinos (0.042 vs 0.022; Chi = 3.52).

The magnitude of direct additive effects ($h^2 \pm SE$) corresponded to that of maternal permanent environmental effects (c^2) for birth weight in an analysis containing both breeds (Table 3). Direct

Table 1. Least squares means (± SE) for birth weight and length of parturition

Effect	Number of lambs	Birth weight (kg)	Length of parturition	
			Mean ± SE	Antilog (min)
Overall mean	1 259	4.14 ± 0.025	1.575 ± 0.017	37.6
Sex		**	**	
Ram	625	4.26 ± 0.031	1.632 ± 0.021	42.9
Ewe	634	4.02 ± 0.033	1.520 ± 0.022	33.1
Breed x order of birth		**	**	
SA Mutton Merino				
Single	105	5.00 ± 0.071	1.844 ± 0.046	69.8
First multiple	305	3.99 ± 0.042	1.790 ± 0.027	61.7
Subsequent multiples	289	3.73 ± 0.043	1.306 ± 0.028	20.2
Dormer				
Single	153	4.59 ± 0.066	1.580 ± 0.044	38.0
First multiple	208	3.84 ± 0.049	1.549 ± 0.032	35.4
Subsequent multiples	199	3.66 ± 0.050	1.386 ± 0.033	24.3

** Significant ($P < 0.01$)

Table 2. Least squares means (± SE) for time lapses from birth to standing and from standing to suckling

Effect	Number of lambs	Birth to standing		Standing to suckling	
		Mean ± SE	Antilog (min)	Mean ± SE	Antilog (min)
Overall mean	1 146	1.343±0.013	22.0	1.463±0.016	29.0
Breed		**		**	
SA Mutton Merino	648	1.302±0.016	20.0	1.389±0.020	24.5
Dormer	516	1.385±0.017	24.3	1.537±0.021	34.4
Order of birth		ns		**	
Single	252	1.334±0.026	21.6	1.401±0.032	25.2
First multiple	469	1.336±0.017	21.7	1.441±0.021	27.6
Subsequent multiples	443	1.360±0.017	22.9	1.527±0.021	33.7

ns Not significant ($P > 0.05$)
** Significant ($P \leq 0.01$)

additive effects were relatively unimportant for length of parturition, but c^2 effects were important. The time lapse from birth to standing was equally influenced by h^2 and c^2 effects. In the case of the period from standing to first suckling, h^2 effects were less important than c^2 effects.

Table 3. Details of the analyses fitting direct additive (h^2) and maternal permanent environmental (c^2) effects to birth weight and behavioural data

Parameter	Birth weight (kg)	Time lapses (min; $\log_{10}$ transformed)		
		Length of parturition	Birth – standing	Standing – suckling
Number of records	1334	1259	1252	1223
Number of sires	57	57	57	55
Number of dams	357	330	337	323
$h^2 \pm$ SE	0.22 ± 0.09	0.02 ± 0.04	0.10 ± 0.05	0.07 ± 0.04
$c^2 \pm$ SE	0.19 ± 0.04	0.17 ± 0.03	0.09 ± 0.04	0.19 ± 0.04

The results regarding length of parturition accorded with previous findings that SA Mutton Merinos had longer parturitions and higher levels of parturient deaths than Dormers (Cloete 1992). The previous finding that length of parturition in ewes was repeatable, is verified by significant c^2 effects found in this study. When analysed from the ewe's perspective with a repeated records model, the significant between ewe variation for length of parturition (Cloete, 1992) will probably also include a direct additive component.

Progress in the neonatal stage appears to have a relatively small h^2 effect. The c^2 effects are probably related to maternal behaviour patterns in the neonatal phase. These include intensive and persistent grooming, co-operation with the first suckling attempts and absence of aggressive behaviour towards the neonate (Alexander 1988). Aspects like teat placement and size may also contribute.

Genetic studies involving lamb survival generally found heritability estimates of ≤ 0.10, leading analysts to conclude that fast genetic progress is unlikely (Yapi *et al.* 1992; Konstantinov *et al.* 1994). This study suggests that at least some of the behavioural characteristics conducive to lamb survival are under genetic control. Since lamb mortalities constitute a major source of reproductive wastage in sheep flocks, a better understanding of the inheritance of behaviour traits conducive to survival will assist in the formulation of a sound breeding strategy.

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