INHERITANCE OF SHORT TAILEDNESS IN
SOUTH AUSTRALIAN MERINOS

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SUMMARY

Results from a study into the inheritance of short tailedness in Merinos are reported. Mating normal long tail (LT) sires to LT dams produced no short tail (ST) whereas mating ST sires to LT and First cross (F1) dams produced 4.0% and 15.0% respectively of ST lambs. Inheritance appears to be by a small number of interacting genes with possible directional dominance for the short tail genes.

INTRODUCTION

A recurring incidence of lambs with short tails born in a flock of South Australian Merinos was first noted by Mr Don Gare of "Mt Glen View" at Jamestown in the mid-north of South Australia in 1956. Since that time Mr Gare has continued to mate a small number of the short tailed rams each year. A co-operative study between Mr Gare and the South Australian Department of Agriculture was established in 1988 to determine the mode of inheritance of the short tail trait and to assess the feasibility of developing a short tail strain of Merino. The background to this study and some early results are described by James *et al* (1990). This paper reports the results of further matings of short tail sires to long tail ewes and the first backcross of F_1 ewes to short tail sires.

MATERIALS AND METHODS

Studies were conducted at Turretfield Research Centre in the lower north of South Australia. The matings reported in this study were of 3 types:

<u>"Long tail" (LT) rams x LT ewes</u>: 15 LT sires mated to 414 LT ewes

<u>Short tail (ST) rams x LT ewes</u>: 6 ST sires were single sire mated to a total of 306 ewes which to our knowledge were unrelated to sheep with any history of the short tail trait.

<u>ST rams x first cross (F_1) ewes</u>: The ewes in this mating were progeny from the first mating (1988) of ST sires to LT ewes at Turretfield which was described by James *et al* 1990. Ewes were divided to 4 mating groups stratified on the basis of marking tail length and sires were randomly allocated to groups. The tail lengths of the ewes (measured at marking) ranged from 5.0 cm to 35.0 cm. The tail lengths of the 4 sires mated were measured prior to mating and were all less than 5cm. These sires were amongst the 6 used in the 1989 mating to LT ewes described above, but were not the sires of the F_1 ewes.

For this mating the rams were fitted with Sire Sine® harnesses and crayon markers were recorded weekly over the 8 weeks recording period. Ewes were scanned with a real-time ultrasound scanner 8 weeks after removal of the rams to check the number pregnant. Lambs were ear-tagged at birth and their dams identified.

Tail length (TL) was measured along the ventral surface from the tail breach junction to the posterior extremity of the tail (excluding wool and hair), the lambs were weighed and any abnormalities noted in lambs recorded at marking (average age 8 weeks) in all groups and also at tagging in the progeny of long tail and F_1 ewes. Lambs with tails less than 12.0 cm at marking were classified as ST. Tail lengths were adjusted to the mean body weight of the 3 groups (14.4kg) using the regression coefficient calculated within groups.

RESULTS

Table 1. summarises the tail lengths measured at marking in progeny from the 3 matings. No progeny from the mating of LT sires to LT ewes were classified as ST. The minimum unadjusted tail length recorded amongst progeny from this mating was 19.0 cm.

Table 1: Tail lengths measured at marking and population parameters for the progeny of short and "long" tailed sires mated to "long" tail and F_1 ewes.

Mating type	Number progeny	Adjusted tail length $(ATL)_A$						% TL <15.7 cm	Percent unajusted TL<12.0 cm
		Mean (cm)	Coef Var (%)	Skew-ness	Kurt-osis	Min (cm)	Max (cm)		
LTxLT	342	27.1	9.4	-0.18	1.39	15.7	34.5	0	0
STxLT	300	24.5	24.0	-0.78	1.12	5.7	33.7	6.0	4.0
STxF_1	60	23.7	34.6	-0.85	-0.32	5.4	35.5	18.3	15.0

$(ATL)_A$: Tail length adjusted for body weight

A total of 12 short tail lambs (4.0%)resulted from mating ST sires to LT ewes and this increased to 15.0% when short tail sires were to F_1 ewes. These figures were reflected by the percentage of lambs with ATL less than 15.7 cm which was the minimum recorded in the progeny from LT X LT matings. A total of 29 lambs measured at birth from the mating of F_1 ewes were not present at marking. Of the 27 lambs lost 8 were recorded as having short tails giving an estimated 19.5% born with short tails. As lambing records were not taken for the ST X LT mating the number of short tail lambs lost before marking is uncertain. The coefficient of variation of both SL and ATL increased as the proportion of short tail "blood" increased. There was also an increase in skewness of the tail length distribution towards the lower tail lengths which was accompanied by flattening of the curve (platykurtosis).

There was a significant difference between sires in the mean tail length of progeny resulting from mating to both "long" tail ewes and first cross ewes. Sires 25 and29 produced progeny of significantly lower mean tail length ($P<0.05$) than sires 26 and 28 and these differences were reflected in the percentage of short tails and the coefficient of variation of tail length in the progeny. The differences were most marked in the progeny resulting from backcrossing. However, both sire 26 and 28 produced progeny with ATL less than the minimum of 15.7 cm recorded from LT x LT matings. The proportions that were less than 15.7 cm were 7.7%, 2.3%, 9.6% and 14.3% respectfully for sires 26, 28, 25 and 29 when mated to 'long' tail ewes and 0%,11.8%, 37.5% and 25.0% respectively when mated to F_1 ewes.

Mating pregnancy and lambing

There were no obvious effects of the short tail gene on fertility amongst the first cross ewes. Pregnancy scanning 8 weeks after completion of mating indicated that 96% of ewes were pregnant. Twenty-seven lambs were recorded as dying between birth and marking. Of these 7 were recorded as having rear end abnormalities, most commonly a blind or restricted anus. All 7 lambs were the progeny of sires 25 and 29 which produced the greatest number of short tailed progeny.

DISCUSSION

If the short tail trait was influenced by a relatively number of genes, possibly acting in an additive manner, a normal distribution of tail lengths with mean midway between the parental types and a similar standard deviation to that of the progeny of LT sires would be expected in the F_1 progeny. The distribution of tail lengths observed in the F1 progeny in this study and in that reported by James *et al*. (1990) suggests that this mode of inheritance is unlikely.

Dennis (1972) recorded an incidence of short tail lambs in Australian Merinos of less than 0.05%. If the trait was determined by a simple recessive factor, from Harvey-Weinberg ratios an incidence of heterozygotes of less than 0.1% would be expected. This is too low to account for the incidence of short tailedness observed among the progeny of ST x LT matings in this study and that reported by James *et al* (1990) and suggests some dominance for the short tail genes.

James *et al*. (1990) noted that it was possible the trait was determined by a single dominant gene with variable penetrance and lethal effect in the first 3 to 4 weeks of pregnancy when present in the homozygous state, as suggested by Carter (1976) for Romneys. The high fertility rate observed when F_1 ewes were back crossed to ST sires suggest it unlikely that a similar gene is responsible for short tailedness in Merinos.

Backcrossing F1 ewes to ST sires has increased the proportion of short tailed lambs, but has provided little additional indication of the exact mode of inheritance. However, the backcrosses did confirm differences in "breeding value" for short tailedness amongst sires which were phenotypically short tailed. At this stage it appears that the short tail trait is determined by a small number of genes with directional dominance or a small number of interacting genes.

The increased incidence of rear end abnormalities observed amongst the progeny of F_1 females and ST sires, particularly the sires with high "breeding value" for short tailedness, is cause for some concern. Whether these abnormalities are an inevitable consequence of selecting for short tailedness, or whether the effects can be separated will be investigated in further studies.

The presence of many sheep breeds around the world, including the Mouflon, the presumed ancestor of present day domestic breeds, which have naturally short tails, but do not have a high incidence of rear end abnormalities may be some cause for optimism that the development of a short tail Merino strain is an achievable objective.

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