AN EVALUATION OF MAIDEN FINN X MERINO AND BOOROOLA X MERINO EWES FOR LAMB PRODUCTION: REPRODUCTION AND WOOL PARAMETERS

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SUMMARY

Reproduction and wool production parameters of 3 alternative crossbred ewe genotypes were compared to Border Leicester x Merino (BLM) control ewes. The alternative genotypes were produced by joining Merino ewes to Booroola Leicester, Border Leicester x Booroola, or 7/8 Finnish Landrace rams. There were no differences between genotypes in fertility (EL/EJ), but, compared with controls, the 3 alternative genotypes showed a large increase in prolificacy (LB/EL). However, the low levels of lamb survival associated with these large litter sizes resulted in no increase in overall reproduction rate (LW/EJ) compared to BLM controls. The BLM ewes produced more wool than the 3 alternative genotypes, but wool from the Border Leicester x Booroola and Finnish Landrace genotypes had a lower fibre diameter.

INTRODUCTION

The number of lambs sold per ewe joined is a major determinant of the profitability of a prime lamb enterprise (Fogarty 1987). However, the crossbred structure of the Australian lamb industry makes selection within existing maternal dam breeds difficult, and the low heritabilities of reproductive traits indicate that only small rates of genetic improvement could be expected (Fogarty 1984). On the other hand, the large variation in reproductive rate that exists between sheep breeds offers scope for improvement by breed substitution.

Two breeds that are capable of improving reproductive rate and are currently available to the Australian lamb industry are the recently released Finnish Landrace (Finn) and Booroola Leicester breeds. The Finn was first released into the Australian industry in 1992 following an importation by UNSW, and more recently by industry via New Zealand. Overseas evaluations suggest that Finns crossed with local breeds can substantially improve reproductive rate but losses in wool production and growth are incurred (Maijala 1984; McMillan et al. 1988). The Booroola Fec^b gene has been available in the Merino for over 15 years but only recently have these genes been transferred to the Border Leicester breed (Booroola Leicester: Stafford and Earle 1990) but there is little information on the performance of their progeny.

UNSW, in a crossbreeding trial, is evaluating Finn and Fec^b genes in prime lamb dam breeds in terms of all traits contributing to the profitability of lamb production, including reproduction, wool production, and lamb growth and carcase traits. This paper presents preliminary data on maiden reproductive and wool production traits of Finn x Merino and Booroola x Merino ewes compared to BLM ewes.

MATERIALS AND METHODS

Production of dam breeds:
During March/April 1992 at the Hay Field Station of the University of NSW, 250 adult Merino ewes of the Peppin strain were joined to each of the following 4 ram genotypes;
A) CSIRO Booroola Leicester (CSIRO - 7/8 BL x 1/8 Booroola Merino). These rams were homozygous for the Fec^b gene; B) UNSW Border Booroola (UNSW - 1/2 BL x 1/2 Booroola Merino). The Fec^b genotype of the rams used was unknown, but its frequency is around 50% in the University flock; C) 7/8 Finn x 1/8 BL (Finn); D) Border Leicester (BLM).
Semen from two Booroola Leicester rams was used by AI, while the other groups were paddock joined to 5 (Finn) or 6 rams. Individual sire was known only for lambs sired by CSIRO and UNSW rams. Ewes were lambed within genotype groups and the lambs were tagged daily when birth date, birth status and birth weight were recorded.

Assessment of reproductive performance
During 1993 the ewe progeny were run with harnessed vasectomised rams to determine the onset of puberty. Raddle marks were recorded every 14 days. In March-April 1994, the ewes were joined to 2% Dorset rams for a 6 week period. Ovulation rate was determined by laparoscopy 7 days before joining and the number of foetuses per ewe was recorded at ultrasound 50 days after the end of joining. The ewes were lambed in genotype groups on irrigated pastures and inspected twice daily when birth date, birth status and birth weight were recorded. The liveweight of lambs was recorded at weaning.

Assessment of wool production
The ewes were first shorn in November 1993 at 14 months of age when greasy fleece weights were recorded and mid-side samples taken. The mid-side samples were measured for mean fibre diameter and fibre diameter variability by optical fibre distribution analyser (OFDA), and for yield and staple length.

Statistical analysis
Means for both the reproductive and wool parameters were compared by LSD using the GLM procedure of SAS (SAS Institute Inc., Cary, NC.). Because individual sire was ignored in the analysis, the standard errors will be underestimated.

RESULTS

The number of ewes joined and means for pre-joining liveweight, reproductive parameters and lamb production are presented in Table 1. A higher proportion of Finn cross ewes reached puberty by 12 months of age than did the other crosses, and puberty occurred some 17 days earlier in Finn cross ewes than in BLM control ewes.

The BLM ewes were heavier at joining than other breeds, but there were no differences between breeds in fertility or in the proportion of ewes ovulating at laparoscopy. The 2 ewe types containing the Fec^b gene had the highest ovulation rate, litter size at ultrasound and prolificacy. Ovulation rate and mid-pregnancy litter size in the CSIRO ewes were 80% higher than in the BLM control ewes, while the Finn cross ewes exhibited a 26% increase in these traits. However, due to an apparent loss of foetuses between ultrasound and lambing, and to significantly lower lamb survival to weaning in the Booroola crosses, there was no net benefit to any of the 3 fecund crosses in reproduction rate or weight of lamb weaned per ewe joined compared to BLM control ewes. Overall, the Booroola Leicester cross exhibited a lower reproduction rate than the other 3 breed types and produced around 50% lower weight of lamb weaned per ewe joined than did the BLM control ewes. Lamb survival decreased as litter size increased, the mean survival of lambs born as singles, twins or triplets being 76%, 54% and 29%, respectively.

Table 1. Means (±SEM) for prejoining liveweight, reproduction and lamb production for hogget crossbred ewes derived from Booroola Leicester, Border Booroola, Finn or BL rams

Trait	CSIRO	UNSW	Finn	BLM
Number ewes joined	47	65	100	90
Liveweight (kg)	41.2 ± 0.7^{a}	38.8 ± 0.6^{b}	40.3 ± 0.5^{a}	44.4 ± 0.5^{c}
Ewes reaching puberty by 12 months (%)	68.8 ± 6.4^{a}	59.4 ± 5.4^{a}	86.1 ± 4.3^{b}	59.8 ± 4.6^{a}
Age at puberty (days)	270 ± 4^{a}	278 ± 3^{a}	257 ± 2^{b}	274 ± 3^{a}
Percent ewes ovulating	89.4 ± 5.1	85.5 ± 4.4	87.9 ± 3.5	83.1 ± 3.7
Fertility (EL/EJ %)	97.4 ± 2.7	100.0 ± 2.2	95.4 ± 1.8	96.3 ± 1.9
Ovulation rate	2.50 ± 0.12^{a}	2.19 ± 0.11^{a}	1.69 ± 0.08^{b}	1.43 ± 0.09^{c}
Litter size at ultrasound	2.39 ± 0.09^{a}	1.91 ± 0.08^{b}	1.63 ± 0.06^{c}	1.37 ± 0.07^{d}
Prolificacy (LB/EL)	1.84 ± 0.10^{a}	1.73 ± 0.08^{a}	1.43 ± 0.07^{b}	1.28 ± 0.07^{b}
Lamb survival (LW/LB %)	31.9 ± 5.6^{a}	55.6 ± 4.5^{b}	66.4 ± 4.2^{bc}	77.1 ± 4.6^{c}
Reprod'n rate (LW/EJ %)	59.0 ± 8.7^{a}	100.0 ± 7.0^{b}	89.9 ± 5.8^{b}	96.3 ± 6.0^{b}
Weaning litter Wt./EJ (kg)	11.33 ± 1.68^{a}	20.48 ± 1.36^{bc}	17.08 ± 1.11^{b}	21.15 ± 1.16^{c}

values with different superscripts within rows are different (P<0.05)

Wool production parameters at the hogget shearing are presented in Table 2. BLM ewes produced 21%, and 11-15% more clean wool than the Finn and Booroola genotypes, respectively. While the Finn and UNSW ewes had a significantly lower mean fibre diameter than did the CSIRO and BLM control ewes, the Finn ewes had a higher coefficient of variation of fibre diameter compared to the UNSW ewes.

Table 2. Means (±SEM) for hogget wool production parameters of crossbred ewes derived from Booroola Leicester, Border Booroola, Finn or BL rams

Trait	CSIRO	UNSW	Finn	BLM
Number	47	66	101	91
GF(kg.)	2.84 ± 0.06^{a}	2.97 ± 0.05^{a}	2.65 ± 0.04^{b}	3.34 ± 0.04^{c}
CFW (kg.)	2.18 ± 0.05^{a}	2.20 ± 0.04^{a}	2.00 ± 0.03^{b}	2.62 ± 0.04^{c}
Mean F.D. (μm)	25.7 ± 0.3^{a}	22.8 ± 0.2^{b}	22.2 ± 0.2^{c}	26.2 ± 0.2^{a}
CV fibre diameter (%)	25.8 ± 0.4^{a}	22.2 ± 0.4^{b}	26.9 ± 0.3^{c}	25.9 ± 0.3^{a}
Staple length (mm)	85.4 ± 1.2^{b}	77.8 ± 1.0^{a}	76.5 ± 0.8^{a}	87.3 ± 0.9^{b}

values with different superscripts within rows are different (P<0.05)

DISCUSSION

The inclusion of Finn or Fec^{B} genes in maiden prime lamb ewes had no effect on fertility compared to the BLM control ewes, but there were substantial increases in prolificacy. This increase was larger in the 2 Booroola cross genotypes than in the Finn cross ewes, and as expected from the frequency of the Fec^{B} gene, progeny of the Booroola Leicester had a higher ovulation rate and litter size than the progeny of

Border x Booroola. The increase in ovulation rate and litter size in the Finn cross, is similar to that reported overseas (Maijala 1984; McMillan et al. 1988). However, due to an apparent loss of foetuses during later pregnancy, especially in the Booroola Leicester group, together with a low lamb survival in the 3 prolific groups, there was no improvement in overall reproductive rate or weight of lamb weaned per ewe joined.

These results are in contrast to those reported by Bindon et al. (1984), who found that the superior prolificacy of crossbred ewes heterozygous for the Fec^b gene more than compensated for their reduced lamb survival compared to control ewes. However their study included data from adult ewes over 2 joinings and was carried out in a more favourable environment. The low lamb survival observed in the present study, especially with multiples, is probably due to maiden ewes lambing in a drought year and emphasises the need to accumulate data over more drops and seasons. The maximum litter size in Finn cross ewes was 2, whereas some 50% of lambs born from the Booroola Leicester cross were triplets suggesting that the Finn gene may be useful over a larger range of environments. The earlier onset of puberty in the Finn cross ewes agrees with overseas data and suggests that the cross may be useful in production systems that join as lambs or utilise accelerated lambings.

The large apparent loss of foetuses in the second half of pregnancy in the Booroola Leicester ewes agrees with the finding of Wilkins et al. (1984) that foetal loss can be significant at this time in ewes with litter sizes greater than two. However, the increased error associated with both scanning and lamb identification as litter size increases may also have contributed to some of the differences observed.

The 3 alternate genotypes evaluated produced less wool than the BLM control, but the penalty was greatest for the Finn cross. Although fleeces were not valued, this loss in fleece weight would be compensated to some extent in the Finn and Border Booroola crosses by their lower fibre diameters. The effect of the greater variability in FD in the Finn cross ewes on wool value needs to be assessed.

In conclusion, these data suggest that Finn and Fec^b genes can increase prolificacy, but poor lamb survival associated with large litters, particularly under difficult environmental conditions, may limit improvement in reproduction rate over the traditional BLM ewe. More data across both years and ages will better assess the effect of these alternative genotypes on the profitability of lamb production.

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