MANAGEMENT AND SELECTION IN A BOOROOLA x ROMNEY BREEDING SCHEME

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INTRODUCTION

Landcorp Farming Limited farms more than 0.8 million Romney breeding ewes throughout New Zealand. Improvement from within-breed selection is applied through four open nucleus breeding schemes. An alternative approach is to exploit between-breed differences. This paper describes an open nucleus breeding scheme using the Booroola gene in commercial Romney sheep.

Description of scheme The scheme is located at Landcorp Farming Ltd's Wairakei Station, 2km north of Taupo in the central North Island. Some 3800 ewes are wintered, comprising of a closed 250-ewe straightbred Control Romney flock, and both a 3000-ewe Base and 500-ewe Nucleus flock of Booroola x Romney sheep (25% Booroola Merino, 75% Romney).

Base-born Booroola x Romney ewes bearing litters of three or more lambs are screened into the Nucleus. Ewes of any age group that satisfied this criterion were initially screened in 1983 (2.3% of ewes lambing), 1984 (4.9%), 1985 (5.1%) and 1986 (7.8%). Since 1987 screening from the Base has been restricted to the two-tooth age group (13.8% of two-tooth ewes lambing in 1987; 8.4% in 1988).

All ewes in the Nucleus and Control flocks are recorded for number of lambs born and number and weight of lambs weaned. Individual lamb weaning weight, autumn and spring live weights and hogget fleece weight are also recorded. Replacements of both sexes for the Nucleus flock are selected on an index incorporating dam's lifetime litter size, and individual's weaning weight, spring live weight and hogget fleece weight. Account is also taken of the individual's estimated breeding value for number of lambs born, and estimated probability of the Booroola genotype (based on ovulation rate data in the female pedigree). Control flock replacements of both sexes are selected at random within dam age classes.

MATERIALS AND METHODS

In 1988 and 1989, all Nucleus ewes were synchronised using CIDRs and laparoscoped in late March-early April to determine ovulation rate. This procedure enabled Nucleus ewe genotypes to be estimated for the first time, using the ovulation rate criterion of <3, 3-4, and >4 to classify the ++, F+ and FF Booroola genotypes respectively. On the basis of this classification in the female pedigree, the average predicted Booroola genotype probability of the five sires used in the Nucleus in 1989 was 0.025 ++, 0.550 F+, 0.425 FF.

Routine laparopscopy is now confined to the two- and four-tooth Nucleus ewes in each year, in order to estimate the ewe's genotype and to use this estimate to predict progeny genotype probabilities.

Control Romney ewes and all Base and Nucleus ewes are pregnancy scanned for expected litter size. It is therefore possible for Base-born two-tooth ewes carrying triplets or higher-order litters to be screened into the Nucleus prior to lambing. These ewes are subsequently laparoscoped as four-tooths to estimate ewe (and progeny) genotype.

Data from the Nucleus and Control flocks were collated from Sheeplan and Landcorp files and averaged over the years 1984 to 1988. Where appropriate, tests of significance were conducted by t-test.

RESULTS AND DISCUSSION

Mean ovulation rates in the Nucleus ewes in 1988 and 1989 were 2.55±0.05 and 2.40±0.05 respectively (pooled value = 2.48±0.04). The percentage of ovulating ewes classified into the ++, F+ and FF genotypes was very similar between years, averaging 52.4, 40.0 and 7.6% respectively, for the pooled data set. The percentage of two-tooth, four-tooth, six-tooth and mixed-aged ewes classified as FF was 5.4, 8.2, 11.3 and 9.7% respectively.

When compared with the recorded number of lambs born to Nucleus ewes in 1988, the percentage of ewes pregnancy scanned correctly was high (87.7%, r = 0.94). However, as expected (e.g., Owens and Armstrong, 1985), scanning accuracy declined with increasing recorded litter size.

The reproductive performance of the Nucleus Booroola x Romney ewes was compared with that of the Control Romney ewes (Table 1). Data in the Nucleus excluded the performance of screened-in ewes in the year of screening.

Despite a lower lamb survival rate (LW/LB), the greater ewe litter size in the Nucleus flock (LB/EL) resulted in an advantage in net reproductive rate (LW/EPL) of 0.2 extra lambs weaned, and 7 kg weight of lamb weaned compared with the Control flock ($P<0.05$).

Table 1 Comparative reproductive performance of Nucleus Booroola x Romney and Control Romney ewes (1984 to 1988).

Trait[1]	Nucleus	Control	Difference (N-C)	sed[2]
EL/EPL	0.97	0.95	0.02	0.02
LB/EL	2.29	1.39	0.90	0.11***
LW/LB	0.60	0.82	-0.22	0.05**
LW/EPL	1.31	1.09	0.22	0.09*
AWW/EPL (kg)	27.1	20.1	7.0	2.49*

[1] EL = Ewes lambing; EPL = Ewes present at lambing; LB = Lambs born; LW = Lambs weaned; AWW = Adjusted weight of lamb weaned.
[2] sed = standard error of difference

Within the Nucleus, reproductive performance differences between ewes of different origins were not significant. Mean ewe litter size was 2.62±0.12 for Nucleus-born ewes, 2.58±0.10 for ewes that had been screened-in as lambs (with their triplet-bearing Base-born dams), and 2.43±0.12 for Base-born ewes that had been screened-in in previous years. Corresponding lamb survival rates per ewe were also not significantly different (0.57±0.07, 0.68±0.06, and 0.61±0.05, respectively).

Lamb weaning weights, hogget autumn and spring live weights and fleece weights did not differ significantly between the Nucleus and Control flocks after adjustment for the effects of age, birth-rearing rank and age of dam (Table 2).

It would be expected that differences in birth-rearing rank between the Booroola x Romney and Romney hoggets would be the major determinant of the actual differences in post-weaning performance observed in the field. Unadjusted weight differences between the Nucleus and Control animals were -4.2, -2.4, -2.2 and 0 kg for weaning weight, autumn weight, spring weight and hogget fleece weight, respectively. These are the differences that must be accomodated by the producer in his management and marketing of multiple-born lambs.

Table 2 Adjusted mean Nucleus- and Control-born lamb weaning (WW), autumn (ALW), and spring (SLW) live weights and fleece weights (HFW)

		WW	ALW	SLW	HFW
Rams:	Nucleus	22.6	37.1	43.3	2.32
	Control	22.7	38.1	43.3	2.52
	sed	1.7	2.2	3.9	0.38
Ewes:	Nucleus	21.3	31.8	36.0	2.40
	Control	20.9	32.0	36.3	2.60
	sed	1.7	1.7	1.5	0.21

CONCLUDING DISCUSSION

Incorporating the Booroola gene into a flock is relatively straightforward, but clearly depends on the accuracy with which gene carriers in subsequent generations can be identified. The routine use of ovulation rate records enables ewe selection for the Booroola genotype to be relatively reliable (albeit conservative). However, the costs involved in routine whole-flock laparoscopy may restrict the measurement to a limited proportion of the flock. Desirably, this should be the younger ewe age groups, but the incidence of multiple ovulations in young ewes early in the season tends to be lower, resulting in a bias downwards in the proportion of ewes positively identified as being homozygous or heterozygous Booroola gene carriers. From the present results, routine laparoscopy of Nucleus ewes in their first two years in the flock could only be expected to identify between 5 and 8% for further breeding as homozygous carriers.

Ram selection is less reliable in the absence of progeny testing. It is therefore planned to commence a progeny testing scheme using an independent Romney ewe flock in order to maintain a Nucleus sire team of FF rams, and thus increase the frequency of the gene in the Nucleus flock.

The Wairakei Booroola x Romney breeding scheme has incorporated the Booroola gene into the Nucleus and Base flocks. The role of the Nucleus flock is progressing towards providing Landcorp flocks with sires which can be used to generate fecund dual-purpose ewes. Because of the higher lambing performance of these Booroola-cross ewes, fewer will be required to generate flock replacements, leaving a higher proportion to be mated to terminal sire breeds.

With a higher reproductive rate, the problem of higher lamb mortality under pastoral conditions remains. An artificial lamb-rearing trial has improved lamb survival rate considerably, but the system has not been cost-effective for commercial application.

REFERENCES

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