PRODUCTIVE CHANGES IN LONGWOOL BREEDS IN NEW ZEALAND FOLLOWING CROSSBREEDING WITH BOOROOLA-TYPE RAMS

R.W. KELLY*, G.H. DAVIS* and A.J. ALLISON*

SUMMARY

Booroola type rams ($\geqslant$ 3/4 Booroola) were flock mated with Romney ewes to produce Booroola cross ewe progeny in 1975 and 1976. Proportions of ewe hoggets ($\sim$ 9 months of age) detected in oestrus, and with multiple ovulations, were significantly higher ($P<0.01$) in Booroola cross than Romney progeny (0.18 - 0.21, 0.33 - 0.35, respectively). Fleece weights and live weights of hoggets were similar for the two breed groups. Two to four year old Booroola cross ewes shed 0.81 - 0.92 more ova per ewe than the Romneys, resulting in 11 - 52% more lambs present at tailing. Fleece weights were up to 0.5 kg lighter in the Booroola cross than Romney ewes. On seven commercial farms where crossbreeding was practised using rams with various proportions of Booroola genes over longwool ewes, crossbred and longwool ewe hoggets had similar fleece weights. The deviation of crossbred progeny from their longwool contemporaries in mean ovulation rates ranged from minus 0.30 to plus 0.77.

INTRODUCTION

In a study of 64 commercial sheep flocks in the South Island of New Zealand, the correlation coefficients between ovulation rate (ova shed/ewes ovulating) and lambs born per ewe lambing (LB/EL) and lambs-tailed per ewe present at mating (LT/EM) were 0.89 and 0.77, respectively (Kelly, unpublished data). It seems reasonable to speculate therefore that methods of increasing ovulation rates in commercial sheep flocks will result in increased lambing performances. This would be of considerable benefit to the farmer through increasing the selection potential possible amongst replacement stock and through the sale of more surplus animals. There are several methods available for increasing ovulation rate, and these can be divided into those related to environmental (e.g., changes in live weight, time of mating) or breeding responses (e.g., selection within breeds, crossing with high fecundity breeds). In this context the high fecundity Booroola Merino offers considerable potential for crossbreeding, and since 1972 approximately 100 animals containing varying proportions of Booroola genes have been imported into New Zealand. This paper reports the changes in reproduction, wool production and live weight in the ewe progeny that have resulted from crossing rams containing varying amounts of Booroola genes with longwool breeds of sheep. Changes resulting from crossbreeding with non-Booroola Merino rams were not included for comparison as published results (Dalton et *al.* 1976) and industry experience indicate that this does not lead to significant increases in reproductive performance in the resultant ewe progeny.

MATERIALS AND METHODS

Data has been derived from two sources. Firstly, from an experiment at Invermay where the lifetime performances of ewe progeny produced in 1975 and 1976 are being recorded and secondly, many commercial sheep farmers in 1978 used rams containing various proportions of Booroola genes, and the hogget performance of the resultant female progeny was recorded in 1979.

* Invermay Agricultural Research Centre, Mosgiel, New Zealand.

Invermay

In 1975 and 1976 Romney ewes were randomised into two groups of 220 or more. In 1975 these groups were flock mated to either four Booroola-type Merino or four Romney rams. Five different rams of each breed were used in 1976, The proportion of Booroola genes in the Merino rams varied from 3/4 to purebred (as determined from available pedigree information) with at least four rams (three used in 1975) being only 3/4 Booroola. One hundred ewe progeny, balanced between breeds for birthrank and birthdate, were selected from each group in 1975 and 1976. Hoggets (i.e. ewes less than 1¼ years old) and older ewes were run as separate flocks, but breeds were not separated. Live weights, reproductive performance (ovulation rates, mating and lambing data) and wool production have been recorded. The performances of the 1975 and 1976 born progeny for each age of ewe (hogget, two, three and four years old) were compared separately for breed effects, using the t-test of binomial proportions or analysis of variance where appropriate. Pooling of data across years was not attempted as breed comparisons within years were free from the effects of years per se and any between year differences in proportion of Booroola genes in the ewe progeny.

Commercial sheep flocks

Merino rams (apparently 1/2 - 3/4 Booroola) originating from the high fertility flock of D.E. Robertson (Robertson 1974) or crossbred rams produced from crossing rams from this source with longwool ewes (Romney, Border Leicester), were mated with longwool ewes on commercial properties in 1978. On seven farms participating in a study on the productive changes following crossbreeding with Booroola-type rams, the crossbred ewe progeny from these matings (n = 44 - 79) were run with progeny of the local purebred as one flock. The number of Booroola-type rams used on each farm to generate the crossbred progeny varied from one to four. Hogget live weights, ovulation rates and fleece weights were recorded in 1979.

RESULTS

Invermay

The progeny from the 1975 and 1976 matings were either Romney (R) or Booroola cross (B x R), the proportion of Booroola genes ranging from 3/8 to one half. The mean live weights, reproductive performance and fleece weights of these animals as hoggets is summarised in Table 1. There were significant differences in the proportion of ewes detected in oestrus ($P<0.01$) and proportion of ewes with multiple ovulations ($P<0.001$) for both year of birth comparisons, but no significant differences in live weight or fleece weight.

TABLE 1 Mean performance of BxR and R ewes as hoggets

Year of birth	Breed	Live weight* (kg)	Proportion of ewes detected in oestrus	Proportion of ewes with multiple ovulations†	Greasy fleece weight+ (kg)
1975	BxR	29.5	0.72	0.38 (1.40)	3.6
	R	29.8	0.54	0.05 (1.04)	3.5
	P	N.S.	**	***	N.S.
1976	BxR	28.8	0.62	0.37 (1.37)	3.8
	R	29.1	0.41	0.02 (1.02)	3.9
	P	N.S.	**	***	N.S.

* 8 months and + 1¼ years old; † at first oestrus, mean ovul'n rates in brackets

The mean performances of ewes at two and three years of age, and one year's data for four year old ewes, are summarised in Table 2. Significant differences ($P<0.01$) existed in nearly all comparisons, with the Booroola cross ewes having lower live weights at mating, more ewes with multiple ovulations and births, and lighter fleeces. The one exception was in two year old 1975-born animals, which had the same mean fleece weight.

TABLE 2 Mean performance of BxR and R ewes at two, three and four years of age

Age at lambing (yr)	Year of birth	Breed	Live weight at mating (kg)	Proportion of ewes with multiple ovulations*	multiple births	LT/EM (%)	Greasy fleece weight (kg)
2	1975	BxR	39.5	0.66 (1.97)	0.64	92	3.8
		R	43.8	0.16 (1.16)	0.12	81	3.8
		P	***	***	***		N.S.
	1976	BxR	43.4	0.61 (1.92)	0.52	102	3.7
		R	45.3	0.10 (1.10)	0.11	67	4.1
		P	***	***	***		***
	1975	BxR	46.1	0.70 (2.18)	0.58	136	4.2
		R	53.4	0.26 (1.26)	0.21	101	4.7
		P	***	***	***		***
	1976	BxR	48.8	0.79 (2.30)	0.66	144	3.6
		R	52.1	0.48 (1.47)	0.41	95	4.0
		P	***	***	**		***
4	1975	BxR	51.6	0.78 (2.50)	0.72	162	3.6
		R	59.2	0.51 (1.63)	0.46	110	4.0
		P	***	***	***		***

* end of first cycle of mating, mean ovulation rate in brackets
P significance of difference between breeds viz. ** $P<0.01$, *** $P<0.001$ (also refers to Table 1).

Commercial flocks

There were nine flocks on seven farms, two farms having crossbred hogget progeny from different ram sources. The progeny were either first cross (three flocks) or first backcross (six flocks) to the longwool breeds, with the proportion of Booroola genes estimated to vary from 1/8 - 3/8. Relative to the longwool ewes, the mean live weights and greasy fleece weights of the crossbred ewes were marginally lower (overall mean differences -0.2 kg and -0.04 kg, respectively). For each of the nine flocks the deviations in mean ovulation rates of crossbreds from longwool ewes were -0.30, 0, 0.01, 0.13, 0.15, 0.23, 0.42, 0.77 and 0.77. In the flocks the proportion of ewes ovulating per breed ranged from 0.32 to 0.95, with a mean value of 0.73.

DISCUSSION

Booroola cross ewe progeny resulting from crossbreeding Romneys with rams containing varying proportions of Booroola genes have had higher ovulation rates at all ages than their Romney counterparts at Invermay. A difference of 0.36 in hogget ovulation rate increased to 0.81 - 0.92 in these ewes at older ages. On the commercial sheep farms the advantages to the crossbred hoggets in ovulation rate varied from minus 0.30 to plus 0.77. As most farmers used only one sire, or crossbred ram progeny from one sire, individual sire effects could be traced. It was of interest therefore to note that the five lower-performing crossbred flocks, relative to the longwool ewes, could all be traced to one particular ram originating from the high fertility flock. This result illustrates a problem that can arise in on-farm evaluations of a new breed, where commercial interests may dictate that only one or a few sires of a new breed are evaluated. Progeny test information on the rams available in this type of situation is of obvious value.

Excluding the results from these five commercial flocks the hogget ovulation rates in the four other crossbred flocks ranged from 0.23 to 0.77 greater than their longwool counterparts, similar to the range of 0.14 to 0.88 previously recorded in Merino cross flocks in New Zealand and Australia (Piper et ***al.*** 1976). Differences of 0.81 - 0.92 between the two breeds at Invermay resulted in differences in LT/EM of 11 - 52%. This relationship is consistent with that recorded in the progeny from the mating of Booroola-type rams with local Merino ewes (Allison et ***al.*** 1977, 1978). These results demonstrate that increases in ovulation rate following crossbreeding with Booroola type rams lead to increases in lambing performance. In flocks of low live weights a 29 - 33% lower level of barrenness has been recorded in Booroola cross ewes with only a 0.07 - 0.12 difference in ovulation rate (Allison ***et al.*** 1978).

Associated with such crossbreeding, using longwool breeds of sheep as the base flock, there will be changes in wool production. Although there may be little difference in hogget fleece weights, the results from the Invermay work show up to 0.5 kg lighter fleeces in older animals. Similar effects have been recorded in Booroola crosses involving finewool breeds (Hawker *et* ***al.*** 1980). The effects of crossbreeding the finewool Booroola with longwool breeds on fleece characteristics of the progeny have been examined by Hawker ***et al.*** (1980), with additive changes in fibre diameter, bulk, staple length and yield, the degree of change depending on the proportion of Merino in the progeny. Concentration of breeding objectives on fleece characteristics in Booroola cross ewes while still maintaining the fecundity levels imparted by crossbreeding should lead to a dual purpose breed suitable to many environments.

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