HYFER - A GENETIC RESOURCE FOR INTENSIVE SHEEP PRODUCTION

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SUMMARY

Hyfer is a composite sheep breed developed from Dorset (½), Booroola Merino (¼) and Trangie Fertility Merino (¼) genotypes. Two generations of selection, based on total weight of lamb weaned in an 8-monthly lambing system, has occurred since the 2 generations of crossing to form the base population. Hyfer sheep have high spring joining ability for flexible year-round lamb production and because flocks are self-replacing there are inbuilt incentives for breeders to make genetic improvement. Hyfer ewes produced 1.98 lambs born/ewe joined/year in an 8-monthly lambing system under natural matings. Estimates of heritability were 0.45 ± 0.10 for liveweight, 0.23 ± 0.08 for fat depth, 0.29 ± 0.08 for fat depth adjusted for liveweight, 0.38 ± 0.08 for greasy fleece weight and 0.10 ± 0.06 to 0.18 ± 0.06 for various measures of mean ewe reproduction from 3 joinings in an 8-monthly regimen over 2 years. The results illustrate the genetic resource that is available to the lamb industry for development of intensive production systems and for continued genetic improvement.

INTRODUCTION

Various markets have been identified for Australian lamb that involve a wide range of specifications, with development of new products aimed at the export and hospitality markets as well as domestic consumers (Thatcher 1986). Under the Meat Research Corporation's Lamb Program there is a thrust to production of heavier, lean carcasses supplied on a year-round basis. These marketing initiatives provide new and exciting opportunities for the lamb industry, but their exploitation depends on adoption of technological change. Dairying and cheese production is another developing intensive industry for sheep (Langford and Dawe 1988). New production systems need to be implemented and existing and new genetic resources utilised if these opportunities for the sheep industry are to be exploited.

Higher lambing rates, ability to lamb at all seasons of the year and exploitation of genetic improvement are all important in meeting market requirements and attaining profitability in intensive lamb production (and in sheep dairying). Hyfer sheep have a high lambing rate and long breeding season which gives greater flexibility of lambing time and, with suitable management and environment, they are capable of successful accelerated lambings. An additional advantage is that there are direct incentives for cumulative genetic improvement through continued selection within the self-replacing breed, which overcomes many of the limitations to genetic improvement within the current crossbreeding structure (Fogarty and Hall 1982). This paper outlines the development of Hyfer sheep, their performance, genetic variation for important traits and their potential for improvement in the intensive sheep industry.

Support for some of this work was provided by the Meat Research Corporation

MATERIALS AND METHODS

Development of Hyfer sheep

The breeding program was initiated by NSW Agriculture in 1978 (Fogarty 1978). Rams from 2 high fertility Merino strains (Booroola and Trangie Fertility) were joined to Poll Dorset ewes. These breeds and strains combine high lambing rate and out of season breeding ability with good lamb growth, carcass quality and wool traits. Rams and ewes of the F1 crosses were reciprocally mated to produce a base population comprising ½ Dorset ¼ Booroola ¼ Trangie Fertility. The base population was interbred and ewes joined in an accelerated lambing system. Following 3 joinings in 2 years (February, October and June), top performing ewes were selected into a nucleus flock to breed replacements. Selection was on the basis of total weight of lamb weaned (adjusted for age and sex) by the ewes from the 3 joinings in 2 years (Fogarty 1984). Rams were selected on their dam's performance (total weight of lamb weaned) with consideration given to growth, leanness and polledness.

Evaluation of performance - experiment 1

Hyfer ewes are being evaluated with traditional Border Leicester x Merino (BLM) ewes under a range of lamb production systems. In this experiment at Cowra, ewes were compared in 2 lambing systems a) Spring-backup - joined in Oct/Nov for 6 weeks with non-pregnant ewes rejoined in Feb/March for 5 weeks; b) 8-monthly joining - split flock with non-pregnant ewes being rejoined 4 months later (Fogarty 1990).

The 326 Hyfer ewes were unselected and the 338 BLM ewes were purchased from 6 properties and matched for age with the Hyfer ewes. The ewes were joined over 4 years from February 1987 to 1991 to either Hyfer, Poll Dorset or Suffolk rams which were selected with average LAMBPLAN EBVs for growth and fat. Ewes were real-time scanned and non-pregnant ewes reassigned to joining groups as per the design. Ewes lambed together and lambs were identified, weighed and tagged within 24 hours of birth. Lambs were reared together and males were randomly assigned, within breed and type of birth, to 3 sex groups (ram, cryptorchid, wether) at marketing. Lambs from each drop were slaughtered in 2 groups at an average of 35 kg liveweight.

Three measures of annual ewe performance, number of lambings, lambs born and lambs weaned per ewe joined, were analysed using REG (Gilmour 1991). Production system and ewe breed were fitted in the model. Ewe performance for joinings only in the spring (Oct/Nov) was also analysed separately.

Genetic variation - experiment 2

Hyfer ewes (1619 born in 14 year/seasons and the progeny of 135 sires) were joined 3 times in 2 years at Leeton in an accelerated 8-monthly lambing system. Joinings were in mid-February (for 5 weeks), late October (for 6 weeks) and mid-June (for 5 weeks) and the first joining was generally in February. Consequently lambings occurred in July/August, March/April and November/December respectively. Lambs were weaned 2 weeks before the ewes were exposed to rams for the next joining.

DFREML analysis methods (Meyer 1989) were used to estimate heritability for hogget liveweight and greasy fleece weight for the ewes and hogget liveweight and fat depth for 1454 contemporary rams, and heritability and genetic and phenotypic correlations for mean performance from 3 joinings for the following reproduction and lamb production traits:

lambs born	-	lambs born per ewe joined (LB/EJ)
lambs weaned	-	lambs weaned per ewe joined (LW/EJ)
weight weaned	-	total weight of lamb weaned per ewe joined (WT/EJ). lamb weaning weights adjusted to 60 days of age and male equivalent and standardised within season (Fogarty 1984).

Realised response to selection for weight weaned is being assessed by divergence from a random breeding control flock joined under the accelerated lambing system. Two contemporary groups born in 1987 and 1988 have completed their performance test of 3 joinings in 2 years.

RESULTS

Performance of Hyfer sheep - experiment 1

Annual lamb production over the 4 years was significantly ($P < 0.01$) higher from the 8-monthly than the spring-backup joining system (Table 1). Ewes had 40% more lambings with 46% more lambs born and lambs weaned/ewe joined/year. There were 23% more lambings, 24% more lambs born and 20% more lambs weaned from the spring-backup system than performance from ewes when only the spring joining was considered.

Hyfer ewes had significantly more lambs born/year than BLM ewes ($P < 0.01$), but there was no difference in the number of lambings/year or lambs weaned/year (Table 1). The interaction of system x breed was not significant for any trait. When performance from only the spring joinings was analysed, Hyfer ewes had significantly ($P < 0.01$) more lambings, lambs born and lambs weaned/ewe joined/year than the BLM ewes (Table 1).

Table 1. Significance of lamb production system and ewe breed and least squares means (± s.e.) for three measures of annual lamb production

	Number of lambings/yr	Lambs born/ ewe joined/yr	Lambs weaned/ ewe joined/yr
Production system	**	**	**
Ewe breed	ns	**	ns
8-monthly			
BLM	1.22±0.02	1.75±0.05	1.47±0.04
HYFER	1.22±0.02	1.98±0.05	1.45±0.04
Spring-backup			
BLM	0.89±0.02	1.23±0.05	1.05±0.05
HYFER	0.85±0.02	1.32±0.05	0.95±0.05
Spring only^			
BLM	0.67±0.02	0.88±0.03	0.77±0.03
HYFER	0.75±0.02	1.18±0.03	0.90±0.03
Significance (breed)	**	**	**

** $P < 0.01$, ns not significant. ^Separate analysis, only including spring joinings in both systems

Genetic variation - experiment 2

The estimate of heritability for lambs born was higher than lambs weaned, with weight weaned being intermediate (Table 2). The estimate of heritability for hogget liveweight was similar for ewes and rams (0.45 ± 0.10), while that for greasy fleece weight was 0.38 ± 0.08 and fat depth was 0.23 ± 0.08 and 0.29 ± 0.08 for fat depth adjusted for liveweight.

The ewe progeny of the selected flock have weaned 14% more lambs and 16% greater weight of lamb, than ewe progeny of the control flock. The differences were consistent over the 2 cohorts of ewes which represented a total of 261 selection flock and 73 control flock ewes. Divergence progressively increased and was greatest from the third joining.

Table 2. Estimates of heritability, genetic and phenotypic correlations (± s.e.) for mean reproduction and lamb production traits^A^

	LB/EJ	LW/EJ	WT/EJ
Lambs born (LB/EJ)	**0.18**±0.06	0.67±0.03	0.57±0.03
Lambs weaned (LW/EJ)	0.70±0.04	**0.10**±0.06	0.93±0.01
Weight weaned (WT/EJ)	0.39±0.06	0.94±0.01	**0.13**±0.06

^A^Heritability on the diagonal, genetic correlations below and phenotypic correlations above.

DISCUSSION

Hyfer sheep are an alternative genotype for the intensive lamb industry. In particular, Hyfer ewes have high fertility and lambing rate from spring joining and are suited to accelerated lambings. Under the 8-monthly joining system they produced an average of 2 lambs per ewe per year over the 4 years in which they were evaluated. The results have also shown that annual lamb production can be significantly increased by adopting more intensive accelerated lambing systems.

There is a high heritability for each of liveweight, leanness and wool weight as well as moderate heritability for measures of reproduction based on 3 ewe records. Early results of selection have indicated divergence from the unselected control flock. Hyfer is a self-replacing breed which means that genetic gains achieved through selection can be accumulated and exploited by breeders.

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