OPPORTUNITIES TO EXPLOIT GENETIC VARIATION AMONG MATERNAL SIRES
IN THE LAMB INDUSTRY

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SUMMARY
The Maternal sire Central Progeny Test (MCPT) is testing 91 maternal sires from several breeds, such as Border Leicester, Coopworth, Finnsheep and East Friesian at three sites: Cowra, Hamilton, Struan/Rutherglen. Common sires used at the sites over three years provide genetic links. There was a large range in sire 1stX estimated breeding values eg. weight (19.8kg) and fat (16.4mm GR). Large differences in lambing rate (81 to 167% weaned) and $ returns ($158 to $263 over three years) were found for 1stX ewe groups at Cowra. Opportunities and strategies for breeders and producers at the various levels in the industry to exploit this variation are discussed.

Keywords: EBVs, meat, ewe performance, LAMBPLAN.

INTRODUCTION
Productivity of the ewe flock has a major impact on the profitability of lamb enterprises. Lamb carcasses (number produced, weight and fat level) and wool (weight and fibre diameter) are the major contributors to income. The potential productivity of the ewes for these traits is determined by their genetic merit. The task is to achieve higher genetic merit among the commercial flocks of crossbred ewes that predominate in the specialist sector of the Australian lamb industry. Crossbreeding has been used very effectively for many years to maximise heterosis. However a wider range of genotypes and genetic technology is now available to achieve more rapid genetic improvement.

The Maternal sire Central Progeny Test (MCPT) is testing sires from several maternal breeds including Border Leicester (BL), Booroola Leicester (BoL), Corriedale (Cr), Coopworth (Cp), East Friesian (EF), Finnsheep (Fi) and White Suffolk (WS) at three sites: Cowra, Hamilton, Struan/Rutherglen. Early results demonstrated variation among sires in performance of their crossbred progeny (Fogarty et al. 1999). Opportunities exist to exploit this variation to improve commercial flocks. The MCPT is also assessing the feasibility of developing across-breed estimated breeding values (EBVs) for maternal breeds in LAMBPLAN, the Australian national sheep genetic evaluation program. New industry structures and breeding alliances need to be developed to foster uptake of genetic technology by the maternal breeding sector and exploit opportunities to bring about more rapid improvement. MCPT results to date are presented and opportunities for the industry to exploit superior maternal genetics are discussed.
MATERIALS AND METHODS
MCPT design. Top maternal sires, based on LAMBPLAN or other performance, were entered by breeders (n=91) and mated to Merino (and Corriedale at Hamilton) ewes to produce 1stX progeny. The 1stX ewes are mated to terminal sires to produce 2ndX slaughter lambs over three years. Lamb production (lambing rate, 2ndX lamb growth and carcass) and wool production (fleece weight and fibre diameter) from the 1stX ewe daughters and growth and carcass performance of 1stX wether progeny are being measured. A total of 91 maternal sires, including three link sires, have been mated at three sites over three years (Cowra and Hamilton, Feb/Mar 1997-1999; Struan, Jan 1998-2000), with 1stX ewes born at Struan, evaluated at Rutherglen. The matings aimed to produce >25 1stX ewes per sire. The production systems for evaluation of the 1stX ewes are: Cowra - ewes split to autumn and spring joining systems, with first joining occurring at 7 and 14 months of age respectively; Hamilton - ewes joined in autumn, with first joining occurring at 7 months of age; Rutherglen - ewes joined in spring/summer, with first joining occurring at 17 months of age.

Management. 1stX progeny were weaned at approximately 12 weeks of age and weighed at weaning and postweaning (7-9) months. 1stX wethers were slaughtered and hot carcass weight, fat depths (GR and C sites), eye muscle depth, width and area (depth x width x 0.008) at the 12th rib were recorded.

At Cowra the autumn joined 1stX ewes born in 1997 (average 16 progeny of 12 sires) were the first group to complete evaluation. They were mated naturally to Poll Dorset rams in Feb/March 1998, 1999 and 2000 to lamb at 1, 2 and 3 years of age. In each year the 2ndX lambs were slaughtered as a group (about 7 months of age) when they reached a target average carcass weight of 22kg. The 1stX ewes were shorn in October of 1998, 1999 and 2000, with greasy fleece weight and classing bin line recorded. In 1998 mid-side samples were also taken for measurement of yield and fibre diameter.

$ returns. Australian five-year average prices for 2ndX lamb carcasses and skins and 1stX wool were used to calculate $ returns. The base carcass price used was $1.95/kg, with discounts for low weight (-1.0 $/kg, <16kg) and fat score (-0.5 $/kg, score 1; -0.4 $/kg, score 5). Trade weight carcasses (16-20kg) were only given a small discount (-0.10 $/kg) because they would normally be sold in the trade market or kept longer to reach heavier weights. Average skin prices were $6.36, $7.67 and $8.42 for 16, 16-20 and >20 kg carcasses respectively.

The five-year average (1995/96 to 1999/00) wool prices for the various micron categories were used to estimate wool returns. For the 1998 hogget shearing the average fibre diameter for each 1stX ewe group was used to determine the average price (c/kg clean) for the group by interpolation, which was then multiplied by the individual clean fleece weight. For the 1999 and 2000 adult shearings each bin line was measured for fibre diameter and yield and the price for the micron category was determined as in 1998. Individual greasy fleece weight was then multiplied by the bin line yield and price. In all years the individual ewe wool return was multiplied by 0.9 to account for the lower price of the non fleece portion.

Statistical analysis. Sire breeding values were estimated (EBVs) for 1stX progeny performance using BLUP procedures in BVEST (Gilmour and Banks 1992) modified from LAMBPLAN. EBVs for weight (postweaning) used birth, weaning and postweaning weights of ewes and wethers and carcass weight of wethers, with adjustments for age and type of birth and rearing. EBVs for fat
(carcass GR) used carcass fat depths at the GR and C sites, adjusted for carcass weight. EBVs for eye muscle area used carcass measurements for area (depth x width x 0.008), adjusted for carcass weight.

RESULTS
There were considerable ranges in the sire EBVs for 1stX meat traits (80 sires) and 1stX wool traits (51 sires) and in particular for weight and fat (Table 1). These values represent very large differences in growth and fat levels in 1stX progeny of these sires. The average number of progeny/sire was 458 for the three link sires and 53 for the other sires. Several sires and breeds were represented among the trait leaders and there was considerable variation between individual sires within the breeds. The East Friesian sires (9 sires tested) were all very lean with an average EBV of −6.1mm GR fat.

Table 1. 1stX estimated breeding values (EBVs)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Sires</th>
<th>Range EBVs</th>
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</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>80</td>
<td>+8.9 -10.9</td>
</tr>
<tr>
<td>Fat (mm GR)</td>
<td>80</td>
<td>-8.2 +8.2</td>
</tr>
<tr>
<td>Muscle (cm²)</td>
<td>80</td>
<td>+1.9 -1.9</td>
</tr>
<tr>
<td>Wool wt. (kg)</td>
<td>51</td>
<td>+1.1 -1.0</td>
</tr>
<tr>
<td>Fibre diam. (µm)</td>
<td>51</td>
<td>+4.8 -5.9</td>
</tr>
</tbody>
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The total lambs weaned per ewe joined (Cowra 1997 drop) over three lambings varied considerably (Figure 1) and ranged from 81 to 167% lambs weaned per ewe joined in 2000. While some other groups had higher percentages of lambs born, due to higher average litter size, lower lamb survival reduced their lamb weaning percentage. Lambing rates were low in 1998 when the ewes were joined at 7 months of age, although one group achieved 100% lambs weaned (Fi3) and others were over 90%. There was reasonable consistency of performance of the ewe groups over the three years.

The total $ returns from the 1stX ewe groups for their lamb carcasses (in and out of specifications), skins and their wool over three years are shown in Figure 2. The top sire group (BL2) returned $263/ewe over three years, which was $105/ewe more than the lowest group or 23% greater than the average. Overall, lamb carcasses contributed 62% of returns, with lamb skins 12% and ewe wool 26%. Lamb value was a

Figure 1. Lambs weaned per ewe for 1997 drop 1stX ewes mated in autumn 1998, 1999 and 2000 at Cowra.

Figure 2. Total $ returns per ewe from lamb carcasses (in and out of spec), skins and wool for 1997 drop 1stX ewes mated in autumn 1998, 1999 and 2000 at Cowra.
higher proportion of returns for those groups with higher lamb production eg. BL2 (81% for carcasses and skins), whereas more valuable fleeces from the Cr11 sire group contributed 37%. There were also large differences in the proportion of carcasses that met specifications to achieve the highest price. The EF6 and BL2 sire groups had a high proportion of carcasses meeting the weight and fat specifications.

DISCUSSION

Progeny testing maternal sires involves two phases corresponding to the 1stX and 2ndX breeding sectors in the lamb industry; firstly the growth and carcass performance of 1stX lambs and secondly the 2ndX lamb performance and wool production of 1stX ewes. The first phase of the MCPT will be completed in mid 2001 when the final 1stX wethers will be slaughtered and 1stX EBVs published for all 91 maternal sires entered. The second phase, evaluation of 1stX ewes over three lambings, will be completed in 2004.

The considerable ranges in 1stX EBVs, especially for weight and fat, are greater than for terminal sires (Banks et al. 1995) and provide considerable scope for selection and genetic improvement within maternal breeds. Choosing sires from the extremes would result in 1stX lambs differing by 10kg post weaning and their carcass fat by 8mm GR or 1.5 fat scores at the same carcass weight. Other results have shown the differences in growth and fat levels persist in 2ndX lambs with a range of up to 6kg post weaning and 5mm GR or 1.0 fat score. There is a dramatic effect of the maternal sire on returns from the 1stX ewe. The major driver is number of lambs slaughtered with wool contributing about 26% of returns.

MCPT results to date show the considerable variation that exists for all lamb production traits. It is also apparent that the leading sires for each of the various traits are different. This highlights the need for breeders at all levels to carefully consider the traits that contribute to their enterprise and select sires accordingly. 1stX, 2ndX and maternal seedstock breeders all have different objectives. The majority of the increased returns from genetic improvement of maternal sires are reaped by the 2ndX breeder, yet they are the farthest removed from the selection decisions because of the tiered crossbreeding structure that exists in the industry. 1stX breeders can make considerable improvement by using sires with high EBVs for growth and leanness. In contrast, 2ndX breeders make the greatest gains from improvement in lambing rate with significant contributions from growth, leanness to match specifications, muscling and wool. 2ndX lamb producers need to exert greater control over the selection and genetic merit of the sires (and dams) of their ewe flock. Contract mating using selected sires, which is being used by some producers and groups, is a means to achieve this.

ACKNOWLEDGEMENTS

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REFERENCES

