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Variation in the New Zealand ram breeding industry – results from the Poukawa progeny test

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ABSTRACT

Between 1998 and 2004 a sire progeny test was run at the Poukawa Research Farm in Hawke's Bay. Four ewe genotypes were used (Romney, East Friesian x Romney, Finn x Romney and Poll Dorset x Romney) with up to 900 ewes mated each year. Data was collected on 4614 lambs born to 74 rams (an average of 62 progeny per ram). Rams used represented 13 different terminal sire and dual purpose breeds. Ewes were mated using AI or single-sire mated in the paddock for one cycle. Lambs were tagged and weighed within 24 hours of birth. At 12 weeks of age, lambs were weighed and scanned for eye muscle dimensions from which eye muscle area was estimated. Data were analysed using a REML animal model taking account of repeat matings among parents, genetic relationships among animals and incorporating adjustments for fixed effects associated with year, ewe genotype and litter size. At a mean lambing percentage of 165%, the mean birth weight across all sires was 4.91 kg and ranged between 4.21 and 5.46 kg for individual sires. The mean 12 week liveweight was 29.8 kg and ranged from 26.5 to 33.1 kg for progeny from individual rams. There was a wide range in GR fat depth (mean 8.9 mm, sire range 6.9 to 12.3 mm) when corrected to a constant carcass weight of 18.3 kg. The top rams for liveweight were not necessarily top for other characteristics.

Significant numbers of lambs are sold store at weaning on a liveweight basis and this makes it possible to place a value on pre-weaning growth. At $2/kg liveweight, the average lamb sired by the top ram for growth would be worth $66.20 and the progeny from the bottom ranked sire would be worth $53 - a difference of $13.20 per lamb. Assuming these rams had an active lifespan of 4 years and mated 80 ewes rearing 125% per year, each ram would leave 400 progeny. At $13.20 per lamb the difference in value between the top and bottom ranked rams would be $5280. These results show the differences between rams and highlight the importance of using breeding values in the ram selection process.

Keywords: progeny test; breeding values; rams.

INTRODUCTION

The Elite Lamb flock was established at the Poukawa Research Farm in Hawke's Bay in 1998 as a demonstration of a high performance flock to evaluate ewe performance (East Friesian and Finn genotypes relative to the Romney). Difficulties in sourcing high growth rate terminal sires led to the establishment of an across-breed central progeny test in 1997. Although an Australian progeny test was operating at this time (Fogarty et al, 2002), most genetic linkages among sire-reference groups and between New Zealand breeds were poor (Piper and Banks, 2003, Campbell et al, 2005). More recently the Alliance Central Progeny Test was set up in 2001 to improve the value of lamb carcasses and provide further genetic links within New Zealand sheep breeds (Campbell et al, 2005).

MATERIALS AND METHODS

Four ewe genotypes were used in the progeny test (Romney (R), East Friesian x Romney (EFxR), Finn x Romney (FxR) and Poll Dorset x Romney (PDxR)). Ewes were farmed as one mob on an area of generally old, established pasture (ryegrass, annual grasses and sub clover) on flat to rolling terrain. The block was managed under as close to commercial conditions as possible. Ewes were weighed and condition scored prior to mating, pre lamb and at weaning. Ewes were vaccinated against clostridial diseases and given preventative treatments for external and internal parasites.

Approximately 900 ewes were mated each year using a range of rams either through artificial insemination or through single sire matings for naturally mated ewes. Sire mating groups were balanced across the four ewe genotypes. Ewes were synchronised for AI using CIDR's and run with teaser rams to detect onset of oestrus. Ewes that did not conceive to rams from the progeny test in the first oestrus cycle were naturally mated with a commercial ram and their data not included. Ewes were drafted into single, twin and triplet bearing mobs based on scanning data and set stocked within a few days of lambing. Ewes were lambed onto as good a pasture cover as possible, ideally over 1400 kg DM/ha of quality feed. Lambs

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were tagged and weighed within 24 hours of birth. At 12 weeks of age, lambs were weighed and ultrasound scanned for eye muscle width and depth ("A" and "B" measurements, Palsson, 1939). Eye muscle area (EMA) was estimated from the product of these two measurements (A x B x 0.77) and adjusted to the average 12 week liveweight of 29.8 kg. Lambs were drafted for slaughter as they reached liveweights of 38 kg (males) and 36 kg (females). Lambs were slaughtered at Richmond's Takapau plant and carcass weight and fatness (GR) data collected and adjusted to the average carcass weight of 18.3 kg.

Between 1998 and 2004, data were collected on 4614 lambs born to 2800 lambings. These represented 74 sires with an average of 62 progeny per ram (range 18 to 168) excluding the link sires. One sire was used to link across years 1998 - 2003 and another to link across years 2002 - 2004. Each link sire is represented in the database by 402 and 280 lambs, respectively. The 74 sires used represent 13 different breed groups and comprised 51 terminal (Poll Dorset, Suffolk, Texel, Dorset Down, Oxford Down, South Suffolk, White Suffolk), 21 dual purpose (Romney, Composite, Coopworth, Dorper, East Friesian, Growbulk) rams. Also included were two groups of rams from the Ruakura Romney facial eczema selection line (unselected for growth since the 1970's).

The analytical model chosen for combined analysis of the data over 1998-2004 was developed from separate, mixed-model, least-square analyses for each trait in each of these years. Estimates of non-genetic effects associated with the sex, birth-rearing rank, age of dam and birth day (covariate), were derived on a within-sire (random) and dam breed/cross (fixed) basis by including these effects in the analysis model, and were found to be similar across years for each trait. Average direct heterosis effects (derived using coefficients varying from 0 to 1 depending on breed of sire and breed of dam or grand-dam and using expectations based on a directional dominance model, Falconer,1982) were also examined as a covariate, but were small (<10%) for most traits.

Breeding value estimates for sires using all available data were obtained as REML estimates using ASREML procedures (Gilmore, 1997). Due to repeated use of a small number of sires across years, a sire model would have been adequate to use these genetic ties to combine results from different years. An animal model, however, gave far greater precision as it also incorporated the genetic ties across years coming from the repeated use of ewes as dams each year. In addition it allowed the separation of direct genetic from maternal genetic effects, only the former being relevant to the evaluation of rams as terminal sires. Animal model relationships also allowed the incorporation of a small number of known genetic relationships among the rams being evaluated.

The breeding value estimates presented came from an animal model fitting direct genetic effects independently of maternal genetic effects and maternal litter effects, on a within sire breed basis. Fixed effects associated with birth-rearing rank, birthday, heterosis and contemporary group were also included in the model. Contemporary group effects identified animals known not to receive equal opportunity to express their breeding worth because of differences in: sex, year of birth and grazing mob, age at measurement; and in age breed/cross, origin (source) and year of birth of their dams. Due to non-random selection of sires for use in the trial, the sire-breed estimates should not be used as a breed comparison, but the individual sire values include both the within and between breed sire effects.

RESULTS AND DISCUSSION

Mean lambing percentage for lambs born within the progeny test was 165%. After correction to this lambing percentage, the mean birth weight was 4.91 kg (range 4.21 - 5.46 kg in Figure 1). Mortality from birth to 12 weeks was 11% across all lambs born and although mortality increased with rearing rank (singles 8.9%, twins 10.3%, triplets 22.8%) there was no evidence that heavier sire birthweights contributed to increased mortality from dystocia. Thomson *et al.,* (2004) has already presented evidence from this flock that this range of lamb birth weights are well within the acceptable range for ewes of this liveweight.

Mean lamb liveweight at 12 weeks was 29.8 kg and represented an average lamb growth rate of 302 g/d. There was a large variation between rams in progeny growth rate, with lambs from the slowest growth sire weighing 26.5 kg at 12 weeks and progeny from the fastest growth sire weighing 33.1 kg at 12 weeks (Figure 1). This meant that the average lamb sired by the fastest growth sire had grown at 340 g/day from birth to 12 weeks.

Increasing numbers of lambs are being on-sold as store lambs on a liveweight basis and for the year ended 30th June 2004, 26.5% of lambs docked on the East Coast of the North Island were sold store (Anon, 2004). This means that pre-weaning lamb growth rate can be valued. In recent years, early season (November) sales of weaned lambs in Hawkes Bay have typically been at or around $2/kg and this makes lambs sired by the best sire worth $66.20 at 12 weeks of age. Lambs sired by the lowest growth sire would be worth $53 – a difference of $13.20 per lambs. Assuming an active lifespan of 4 years and annually mating 80 ewes rearing an average of 1.25 lambs, each ram would leave 400 progeny. With a difference in store lamb value of $13.20 per lamb, the difference in lifetime progeny value would be $5280. Increasing the number of lambs weaned or the price would further enhance this value. These results emphasize the potential differences in value between sires and highlight the value of genetic merit in the ram selection process.

There was a wide range of variation between sires in the eye muscle area measurements obtained from ultrasound scanning at 12 weeks (EMA, Figure 1). At the same liveweight (29.8 kg), average progeny eye muscle area was 10.8 cm^2 with a range from 9.7 cm^2 to 12.9 cm^2. There was a similarly wide variation in carcass fatness (GR, Figure 1). At a carcass weight of 18.3 kg, the average lamb had a GR of 8.9 mm but there was a range between sire progeny of 6.5 mm to 11.9 mm. As demonstrated by Campbell et al (2005) these results showed that while within a trait there was considerable variation between sires, no individual sire (Figure 1) or breed (Table 1) dominated all traits. For example, progeny from the top liveweight sire were average for carcass fatness but below average for eye muscle area (Figure 1). This means there is considerable opportunity for farmers to select sires which meet the requirements for their particular farming situation and the best sire will vary between situations.

These sire evaluations provided the opportunity to examine the progress made within the New Zealand sheep breeding industry, by comparing ram rankings to a group of sires dating back to the original Ruakura Romney facial eczema selection lines. For the latter flock, breeding values for growth have changed little changed since the 1970's (C Morris, *pers comm.*) There were 12 of these rams used over 1999 and 2000, they were grouped by year and represented as the "unselected" sires (for growth) in Figure 1. The 121 progeny from these two groups of rams weighed 26.6 kg at weaning whereas the 347 progeny from 8 "modern" Romney rams weighed on average 29.0 kg at weaning. Whilst the particular sample of rams used in the progeny test may not reflect the national average, this difference in breeding values between the "modern" Romney rams and the "unselected" group is encouraging.

FIGURE 1: Range in breeding values for 74 sires for birth weight, 12 week weight, eye muscle area (corrected to a liveweight of 29.8 kg) and GR (corrected to a carcass weight of 18.3 kg). On each graph the rams are in the same order.

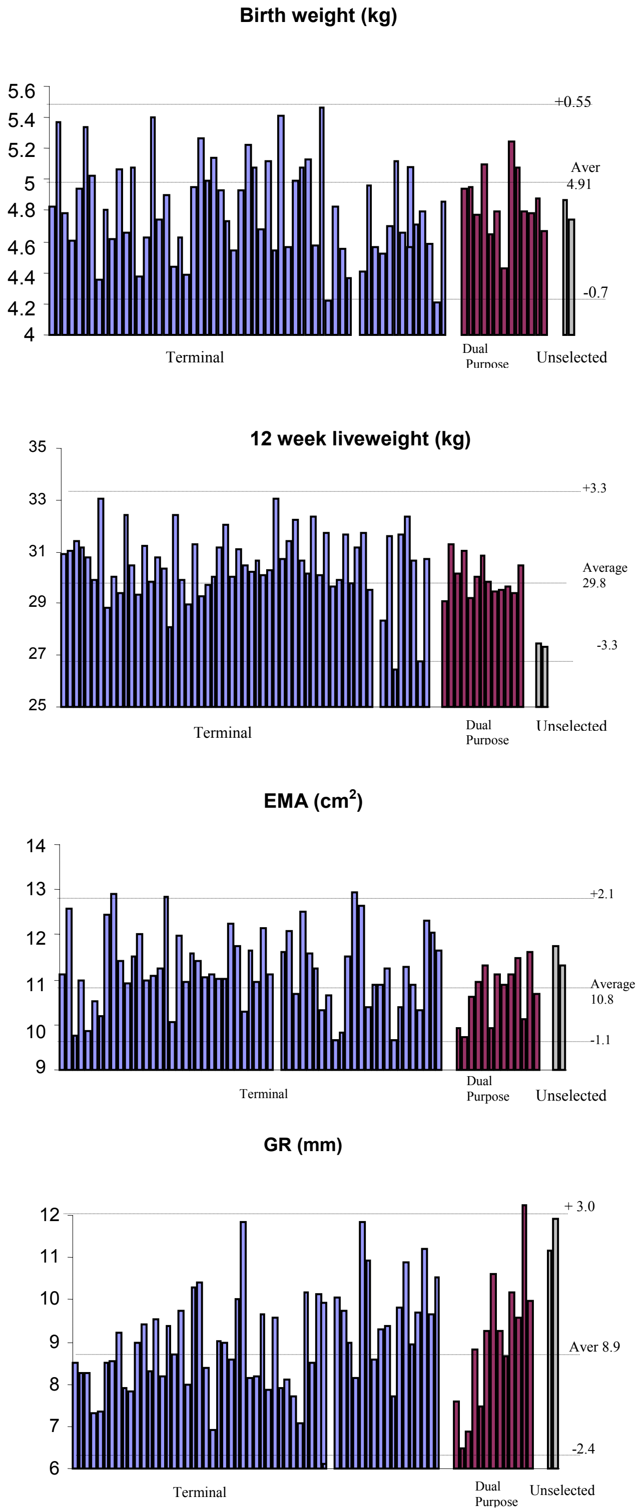

TABLE 1: Average sire genetic merit for 4 breed groups (range in brackets) of birth weight, 12 week weight, eye muscle area (EMA) corrected to 29.8 kg liveweight at 12 weeks, and GR corrected to a carcass weight of 18.3 kg.

		Sire genetic merit and ranges within breeds			
Sire Breed	No rams	Birth weight	12 week weight	EMA	GR
Poll Dorset	20	4.68	30.6	11.5	9.3
		(4.37 - 5.07)	(29.0 - 32.2)	(9.8 - 12.9)	(7.1 - 11.8)
	SD	0.21	0.91	0.78	1.32
Suffolk	18	4.92	31.1	10.9	9.0
		(4.22 - 5.46)	(29.3 - 33.1)	(9.8 - 12.6)	(7.4 - 11.2)
	SD	0.37	1.09	0.82	0.93
Romney	8	4.91	29.8	10.8	8.9
		(4.65 - 5.24)	(29.1 - 31.0)	(9.9 - 11.5)	(7.5 - 10.2)
	SD	0.22	0.65	0.54	1.02
Texel	7	4.86	30.7	11.6	8.4
		(4.61 - 5.22)	(29.4 - 31.7)	(11.0 - 12.9)	(7.3 - 10.3)
	SD	0.26	0.80	0.66	0.93

Of the 74 rams used, 53 were from 4 breeds - Poll Dorset (20), Suffolk (18), Romney (8) and Texel (7). While there were not sufficient rams to make sweeping statements about the relative performance of breeds, a wide range of variation is clearly apparent within breed (Table 1), showing it is more important to select rams on breeding values (irrespective of breed) than to select rams on breed

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