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Carcase weight and dressing percentage are increased using Australian Sheep Breeding Values for increased weight and muscling and reduced fat depth

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ABSTRACT

Pre-slaughter live weight, dressing percentage, and hot standard carcase weight (HCWT) from the 2007, 2008, 2009 and 2010 birth-years of the Information Nucleus Flock Lambs (n = 7325) were analysed using linear mixed effects models. Increasing the sire breeding value for post-weaning weight (PWWT), and c-site eye muscle depth (PEMD), and reducing the sire breeding value for fat depth (PFAT) all had positive impacts on HCWT. The magnitude of the PWWT effect was greater in pure bred Merinos compared to Maternal and Terminal sired progeny. The improved HCWT resulting from increased PEMD was entirely due to its impact on improving dressing percentage, given that it had no impact on pre-slaughter live weight. There were marked differences between sire types and dam breeds, with pure-bred Merinos having lower pre-slaughter weight, reduced dressing percentage, and lower HCWT than progeny from Terminal and Maternal sired lambs or progeny from Maternal (1st cross) dams.

1. Introduction

Dressing percentage is the proportion of hot standard carcase weight (HCWT) relative to pre-slaughter weight, expressed as a percentage. This parameter is of particular importance to producers selling on the basis of HCWT as the live weight prior to dispatch combined with dressing percentage and some measure of fatness enables them to more accurately target the carcase specifications of a price grid. However, there is currently no direct method for Australian prime-lamb producers to select for this trait, with the emphasis of selection for carcase traits targeted towards rapid lean growth.

Dressing percentage for sheep can vary markedly, and is impacted upon by a range of factors including nutrition, maturity, wool growth, and breed. Nutrition is of particular importance, leading to variation in gut-fill that can markedly influence visceral weight and therefore dressing percentage. Thus Sheridan, Ferreira, and Hoffman (2003) demonstrated that the greater the roughage component of a diet, the greater the associated gut-fill, and the lower the dressing percentage. The effect of maturity on dressing percentage is due to the visceral portion of sheep maturing earlier than the carcase component (Butterfield, 1988). Therefore, older larger lambs will have higher dressing percentages than younger smaller lambs (Hawkins et al., 1985; Sheridan et al., 2003). Alternatively, when compared at the same weight large mature size lambs will be less mature and therefore have a lower dressing percentage than smaller mature size lambs.

In Australian Merinos, mature size is positively correlated (0.56) with the Australian Sheep Breeding Value (ASBV) for post weaning weight (PWWT) (Huisman & Brown, 2008). Thus it seems likely that the progeny of high PWWT sires will have lower dressing percentages than the progeny of low PWWT sires when compared at the same live weight.

Selection for leanness has also been shown to reduce dressing percentage in pigs (Cliplef & Mckay, 1993; Mcphee, 1981). Likewise, Kremer et al. (2004) demonstrated higher dressing percentage in the progeny of Texel sires compared to Corriedale sires, with the Texel breed noted for producing lambs with increased muscling and reduced fatness. However, these studies have compared genotypes that have been concurrently selected for rapid growth, confounding

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the interpretation of this effect. Within the Australian lamb industry, leanness can be selected for using the ASBV for post weaning fat depth (PFAT) (Gardner et al., 2010). Thus, if selection for leanness were to affect dressing percentage, we could assume that the progeny of low PFAT sires would have reduced dressing percentage compared to the progeny of high PFAT sires.

Breeds have also been shown to differ in dressing percentage — particularly Merinos which demonstrate consistently lower dressing percentage than first and second cross lambs (Gardner, Kennedy, Milton, & Pethick, 1999; Ponnampalam, Hopkins, Butler, Dunshea, & Warner, 2007). Due to the relatively slow growth of Merino lambs, these studies are often confounded by live weight when the breeds are compared at the same age. Therefore it is possible that this difference merely reflects the smaller and less mature status of the Merino lambs. Fogarty, Hopkins, and van de Ven (2000) attempted to overcome this by correcting for carcase weight in an analysis of 2400 lambs. While they were able to demonstrate lower dressing percentage in Merino lambs compared to first cross lambs, there were relatively few lambs at the same weight between the different sire groups creating some uncertainty regarding this comparison. Hence, to confirm that this difference is not merely a reflection of live weight and maturity, research is required where Merino lambs are compared to other breeds at the same weight and the same nutritional history.

This paper analyses data from the Information Nucleus Flock (INF) experiment which has been run by the Australian Cooperative Research Centre for Sheep Industry Innovation (Sheep CRC). We describe the impact of genetic and non-genetic factors on dressing percentage and its components, live weight and carcase weight. We hypothesise that dressing percentage will be higher with increasing pre-slaughter live weight, but will be lower in the progeny of sires with high PWWT breeding values and low PFAT breeding values. Independent of these effects dressing percentages will be lowest in Merinos when compared to other breeds at the same weight.

2. Materials and methods

2.1. Experimental design and slaughter details

The design of the Sheep CRC INF is detailed elsewhere (Fogarty, Banks, van der Werf, Ball, & Gibson, 2007; van der Werf, Kinghorn, & Banks, 2010). Briefly, about 10,000 lambs were produced from artificial insemination of Merino or Border Leicester–Merino dams over a 5 year period (year 2007–2011). The breeding program was undertaken at eight research sites across Australia (Katanning WA, Cowra NSW, Trangie NSW, Kirby NSW, Struan SA, Turretfield SA, Hamilton VIC, and Rutherglen VIC), which represent a broad cross-section of Australian lamb production systems. Lambs born in 4 years (2007–2010) were used for this study. The lambs (Merino, Maternal × Merino, Terminal × Merino and Terminal × Border Leicester–Merino) were the progeny of 363 industry sires, representing the major sheep breeds used in the Australian industry. The sires types included Terminal sires (Hampshire Down, Ile De France, Poll Dorset, Southdown, Suffolk, Texel, White Suffolk), Maternal sires (Bond, Booroola Leicester, Border Leicester, Coopworth, Corriedale, Dohne Merino, East Friesian, Prime South African Meat Merino, White Dorper), and Merino sires (Merino, Poll Merino). After weaning at 90 days of age the lambs were grazed under extensive pasture conditions and supplemented with grain, hay or pellets when pasture was limited, the frequency of which varied between sites (Ponnampalam et al., 2013). All male lambs were castrated.

2.2. Slaughter protocol and HCWT and dressing percentage measurement

At each INF site lambs were consigned to smaller groups on the basis of live weight, with each group killed separately (kill groups) to enable a target carcass weight of 21.5 kg to be achieved. Within a year, we attempted to represent each sire with progeny in each kill group, although due to the slower growth rates in Merinos this was not always possible. Hence of the 112 kill groups in this experiment, 14 consisted entirely of Merino sired progeny, 38 consisted of only Maternal and Terminal sired progeny, and a further 60 consisted of lambs from all three sire types.

At all INF sites, lambs were yarded within 48 h before slaughter, maintained off-feed for at least 6 h, and then weighed to determine pre-slaughter live weight. They were then transported for 0.5–6 h via truck to one of 6 commercial abattoirs, held in lairage at the abattoir for between 1 and 12 h, and then slaughtered.

All carcasses were electrically stimulated and trimmed according to AUSMEAT standards (Anon, 1992), and hot standard carcase weight (HCWT) was then measured within 40 min of slaughter. Dressing percentage was calculated as HCWT divided by pre-slaughter live weight and expressed as a percentage. All lambs were measured and sampled for a wide range of carcass, meat and growth traits including GR tissue depth, loin weight, shortloin fat weight and wool length. GR tissue depth was measured 12 cm from the midline over the 12th rib, and was taken as the total tissue depth above the surface of this rib. To prepare the shortloin (4880), the hind quarter was separated from the carcase by a cut through the mid-length of the sixth lumbar vertebrae. A second cut was then made between the 12th and 13th rib to separate the lumbar section of the saddle which was then split down the midline. Lastly the flaps were removed by a single cut 25 mm from the lateral edge of the *m. longissimus lumborum*. The subcutaneous fat from the shortloin was then dissected and weighed. Then the *m. longissimus lumborum* was dissected from the shortloin and also weighed and recorded as “loin weight”. Wool length of the skin was measured after skin removal and within 6 h of slaughter, prior to salting (mean ± STDEV, min–max; 48.3 ± 25.8 mm, 10–150 mm).

Table 1
Number of progeny analysed in the HCWT and Dressing Percentage analysis at each site according to year, sex, sire type, birth-rearing type and dam breed within sire type.

Site	Year				Sex		Sire type			Birth-rearing type						Dam breed (sire type)				Total
	2007	2008	2009	2010	F	M	Maternal	Merino	Terminal	11	21	22	31	32	33	BLM	MM	TM	TBLM	
Kirby	233	391	279	360	404	859	272	224	767	629	169	441	12	11	1	272	224	324	443	1263
Trangie	0	217	193	199	198	411	117	120	372	124	30	330	8	42	75	117	120	147	225	609
Cowra	284	144	197	185	252	558	147	108	555	185	76	390	15	77	67	147	108	311	244	810
Rutherglen	292	213	208	204	301	616	137	126	654	241	49	526	11	30	60	137	126	115	539	917
Hamilton	192	191	167	180	249	481	130	107	493	355	81	266	4	14	10	130	107	309	184	730
Struan	257	123	172	163	245	470	135	74	506	231	56	362	5	33	28	135	74	105	401	715
Turretfield	261	215	213	235	297	627	183	154	587	282	50	492	5	29	66	183	154	390	197	924
Katanning	359	308	328	362	415	942	325	238	794	542	108	630	10	47	20	325	238	683	111	1357
Total	1878	1802	1757	1888	2361	4964	1446	1151	4728	2589	619	3437	70	283	327	1446	1151	2384	2344	7325

F, female; M, male (wethers); BLM, Border Leicester × Merino; MM, Merino × Merino; TM, Terminal × Merino; TBLM, Terminal × Border Leicester–Merino. Note: numbers shown reflect data available for the dressing percentage analysis where the data set was smallest.