

UNIVERSITY OF NEW ENGLAND
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**Relationships between clean fleece weight, reproduction and fatness
in adult Merino ewes and growth, fleece, carcase attributes and
survival in their progeny.**

By

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Abstract

Concerns that high clean fleece weight (CFW) sheep were likely to be less fit during drought has been expressed by producers and has been supported to some degree by animal house experiments. These experiments predominantly used dry sheep, and found high fleece weight genotypes were leaner and had lower circulating energy levels. Conclusions from the experiments implied that reductions in reproduction will occur as a result of an emphasis on CFW selection. This thesis has examined the hypothesis that breeding ewes, selected for high or low CFW and high or low body weight and held at two levels of stocking rate, will partition nutrition differently with reductions evident in body fat and reproduction for high CFW animals. Also examined were the effects on carcass quality and growth in their offspring.

Adult ewes (5-8 y.o.) were selected on the basis of their hogget CFW and hogget off-shears body weight (BWT). Over two years, adult ewes were held at two levels of stocking rate throughout pregnancy and from marking to joining and liveweight, body fat score, ultrasound scanned fat and muscle depth and reproduction were recorded. The first drop of wether progeny were retained for slaughter to determine the effects on carcass quality and the first drop of ewe progeny were retained for measures of hogget fleece production. The final experiment examined controlled feed intake and metabolic energy reserves in the dams under animal house conditions, and the implications for rearing twin lambs.

The two year field study revealed that high CFW ewes were heavier, had less muscle depth and less fat depth compared to low CFW ewes, and that twin bearing ewes lost the greatest amount of fat score during lactation. These findings support the concerns that high CFW Merino dams may be more vulnerable to severe nutritional stress, a consequence of the Merino's history of selection for high CFW. However, the size of the effect was not large and there were no interactions between stocking rate and the tissue depths. Based on the phenotypic correlations between wool weight and animal fatness it would be expected that the high CFW dams would be marginally fatter and this was true in two instances in this study: for dams that failed to wean lambs, but only at times equivalent to mid pregnancy and lambing and during the post-weaning recovery period, where high CFW dams tended to replete their fat score faster than low CFW dams. Rates of depletion and repletion indicate that high CFW dams are

responsive to the demands of pregnancy and wool growth, regardless of the level of stocking rate.

During the two years of this study, no significant reductions in fertility or weaning rates were observed and while the probabilities of reproductive failure in high CFW ewes for conception, postpartum and weaning were higher, no significant difference was observed. No differences were observed in the cause of neonatal mortality between the CFW lines.

Progeny growth to weaning and post-weaning was significantly higher in lambs bred from high BWT dams. With respect to the effects of CFW there were no significant differences.

The retention of wether progeny for slaughter as lambs has showed that phenotypic selection for BWT will have favourable effects on carcass attributes including weight, fatness and *m. longissimus thoracis et lumborum* dimensions, with the exception of temperature at pH 6.0. This experiment showed that while variation does exist within a bloodline, it is clear that managing dams at two stocking rate levels and applying phenotypic selection towards increased CFW is not likely to have largely deleterious impacts on measures of meat quality.

The animal house experiment revealed that high CFW ewes and their lambs have significantly elevated insulin concentrations compared to low CFW animals. In the high CFW ewes, elevated insulin did not consistently result in lowered glucose, nor increased muscle depth, fat depth or fat score. In fact, muscle depths were lower in the high CFW ewes. The high CFW progeny showed significantly elevated insulin and NEFA levels 2 h postpartum, while tending to have lower glucose and lower lactate concentrations compared to low CFW lambs. Consistent with earlier field observations, a lower percentage of lambs were weaned, but the difference was not significant.

The implications of the findings in this thesis extend to discussion on fitness: the capacity to survive and to reproduce under varying conditions. The findings show that in this study, twin bearing high CFW dams lose the most liveweight, muscle depth, fat

score and fat depth while growing heavier fleeces, but that the effects on their body reserves do not persist. This suggests an ability to compensate fat reserves when the demands of pregnancy and lactation cease, which is supported by elevated circulating insulin concentrations. Evidence from slaughter and in progeny growth rates show that Merinos benefit from BWT selection, and there were no undesirable consequences of selection for both traits. The conclusion is that because the reductions in muscle depth and fatness are small, selection for increased CFW should continue.

Publications arising from research reported in this thesis

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