DOES TRANSLOCATING SHEEP BETWEEN ENVIRONMENTS AFFECT WOOL PRODUCTION AND WOOL QUALITY OF MERINO WETHERS?

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SUMMARY

The effect of translocating superfine, fine and medium wool Merino wethers from a traditional tablelands fine wool environment to a non-traditional western environment was examined for a range of body weight, wool production and wool quality traits. Micron group and environmental effects rather than bloodline and age effects are driving changes in the traits. Body weight and wool production dramatically improve in western environments with little effect on wool quality.
Keywords: Merino, wool production, wool quality, environmental effects

INTRODUCTION

Trends in the wool market over the past 10 years have shown a consistent price advantage for finer wool. This trend reflects a shift in demand by wool processors and consumers towards increasingly lighter weight apparel fabrics. In NSW at present, the majority of fine wool is produced by a small number of bloodlines located in quite restricted areas of the tablelands - northern, central and southern. Any significant increase in fine wool production is therefore likely to occur through utilisation of these fine wool genotypes in regions which are best described as "non-traditional fine wool environments". Production of fine wool in non-traditional environments will most likely occur through a combination of the use of fine wool rams over existing bloodlines and the actual transportation of fine wool sheep, be they ewes or wethers, from their traditional areas into these "new" environments. The aim of this paper was to investigate the effect of translocating sheep between environments on body weight, wool production and quality.

MATERIALS AND METHODS

Between 1992 and 1996, the majority of wethers from the CSIRO Fine Wool Project bloodlines (Swan *et al.* 1993) at Armidale, a typical fine wool environment, were transferred to the Condobolin Agricultural Research and Advisory Station (ARAS), a typical medium and broad wool environment, following their hogget shearing. The wethers remained at Condobolin ARAS for four consecutive shearings. Prior to shearing in August of each year, a midside sample was taken from each wether and tested to provide the average fibre diameter, percentage yield, staple length and staple strength measurements. At shearing each fleece was weighed to determine the greasy fleece weight with percentage yield used to calculate clean fleece weight. Off shears body weights were recorded for each wether. The data from the transferred wethers, including their hogget shearing at Armidale, were coded according to micron group (superfine, fine or medium), bloodline (1 to 11), location (Armidale - hogget shearing, Armidale x Condobolin - 2 year old shearing of wool principally grown at Condobolin or Condobolin - 3 to 5 year old shearings) and age (1,2,3,4 or 5 years). REG, a generalised linear models program (Gilmour, 1993), was used to analyse the data. The analysis involved initially fitting a model with the main effects of bloodline and age with the bloodline x age interaction term and then partitioning the interaction term into its main components. The significance of each of the interaction terms as well as their contribution to the total sums of squares for the bloodline x age interaction from the initial model were determined for each trait.

RESULTS AND DISCUSSION

The bloodline, age and the bloodline x age interaction term were all significant sources of variation in each of the traits indicating that the bloodlines responded differently to increasing age and/or change of environment. Partitioning the bloodline x age variance (Table 1) identified the micron group x location interaction as the major contributor to the performance of the wethers for all traits (P<0.001). Of course, age and location were partially confounded but interactions with location would appear to be the more important influence. Although the bloodline (within micron group) x location interaction term was also significant for all traits (P<0.001), this term generally accounted for a smaller percentage of the total interaction sums of squares, with the exception of staple strength, where the percenrage contribution for the bloodline x location interaction was 11 % higher than that for the micron group x location term.

Table 1. Mean squares (MS), significance and percentage contribution (%C) of each interaction term (1, 2, 3 or 4*) to the total interaction variance for body weight and wool production and quality traits

Trait	Interaction Terms											
	1			2			3			4		
	ms		%c	ms		%c	ms		%c	ms		%c
Body weight (kg)	594	***	38	137	***	34	135	*	8	77	*	19
Greasy fleece weight (kg)	57	***	83	2.2	***	12	2	***	3	0	ns	1
Yield (%)	1766	***	67	175	***	27	41	ns	2	28	ns	4
Clean fleece weight (kg)	46	***	93	1	***	4	1	***	2	0	ns	1
Fibre diameter (μm)	49	***	71	3	***	18	5	***	7	1	ns	5
Staple length (mm)	1800	***	68	125	***	19	131	*	5	56	ns	8
Staple strength (N/ktex)	478	***	27	171	***	38	315	***	18	78	ns	17

* 1. Micron group x Location; 2. Bloodline within micron group x Location; 3. Micron group x age at Condobolin; 4. Bloodline within micron group x age at Condobolin.

Although the bloodline x age interaction term indicated that the bloodlines responded differently to increasing age, partitioning the interaction term into its components shows that it is the micron groups (ie superfine, fine and medium) that are driving the bloodline effect and that within micron groups the bloodlines are reacting more similarly. Further, when the age effect is divided into its components, it is the change in location that is driving the differences, not age related changes *per se*.

The difference in body weight between the three micron groups increased by more than 100 % between their hogget shearing in Armidale and their 3 year plus shearings at Condobolin (Table 2). At each shearing the results were as expected, with the medium wool group always the heaviest, followed by the fine and superfine groups. It is important to note, that based on their body weights at Condobolin, both superfine and fine wethers will achieve an acceptable carcase weight of 22 kg, assuming a dressing percentage of 40 %, when moved to non-traditional fine wool environments and sold as 3 year olds or older. Therefore producers shifting to fine wool production in these environments will not necessarily lose revenue as a result of selling fine or even superfine wethers as store sheep compared to traditional medium and broad wool types.

Table 2. Least squares means (±se) for each superfine, fine, and medium wool wethers at Armidale, Armidale x Condobolin and Condobolin *

Trait		Armidale	**Group** Armidale x Condobolin	Condobolin
Body weight (kg)	Superfine	26.2 ± 0.7 [a]	46.4 ± 0.7 [d]	54.4 ± 0.7 [g]
	Fine	27.2 ± 0.7 [b]	48.9 ± 0.7 [e]	58.5 ± 0.8 [h]
	Medium	29.0 ± 0.8 [c]	52.9 ± 0.8 [f]	61.5 ± 0.9 [i]
Greasy fleece weight (kg)	Superfine	2.41 ± 0.05 [a]	4.03 ± 0.05 [d]	4.63 ± 0.05 [g]
	Fine	2.71 ± 0.05 [b]	4.79 ± 0.05 [e]	5.70 ± 0.05 [h]
	Medium	3.30 ± 0.06 [c]	6.07 ± 0.06 [f]	7.02 ± 0.06 [i]
Yield (%)	Superfine	72.1 ± 0.5 [a]	62.0 ± 0.5 [c]	57.6 ± 0.5 [f]
	Fine	74.8 ± 0.5 [b]	66.2 ± 0.5 [d]	62.0 ± 0.5 [c]
	Medium	73.1 ± 0.6 [a]	69.4 ± 0.6 [e]	67.5 ± 0.6 [g]
Clean fleece weight (%)	Superfine	1.74 ± 0.03 [a]	2.48 ± 0.03 [d]	2.68 ± 0.04 [g]
	Fine	2.03 ± 0.04 [b]	3.14 ± 0.04 [e]	3.56 ± 0.04 [h]
	Medium	2.41 ± 0.04 [c]	4.18 ± 0.04 [f]	4.75 ± 0.04 [i]
Fibre diameter (μm)	Superfine	16.7 ± 0.1 [a]	17.3 ± 0.1 [c]	17.8 ± 0.1 [d]
	Fine	16.8 ± 0.1 [a]	17.6 ± 0.1 [d]	18.4 ± 0.1 [b]
	Medium	18.3 ± 0.1 [b]	19.9 ± 0.1 [e]	20.9 ± 0.1 [f]
Staple length (mm)	Superfine	79.9 ± 0.7 [a]	80.6 ± 0.7 [a]	80.8 ± 0.7 [a]
	Fine	88.5 ± 0.8 [a]	89.6 ± 0.8 [d]	90.1 ± 0.8 [b]
	Medium	99.8 ± 0.8 [c]	101.6 ± 0.8 [d]	102.1 ± 0.9 [d]
Staple strength (N/ktex)	Superfine	42.4 ± 0.8 [a]	31.4 ± 0.8 [b]	30.1 ± 0.8 [b]
	Fine	41.6 ± 0.8 [a]	31.3 ± 0.8 [b]	30.7 ± 0.8 [b]
	Medium	42.3 ± 0.9 [a]	30.6 ± 0.9 [b]	33.9 ± 0.9 [c]

* Different superscripts within a trait denote significant differences.

The percentage yield of the wool decreased in the non-traditional fine wool environment. This is largely due to the differences in land usage and soil types between the tablelands areas, which are a predominantly grazing system on trap, granite and basalt soils compared to the Condobolin environment which is a typical cereal/sheep system based on red soils. In each instance, the yield of the superfine wool was lower than that of the fine and medium wools and this difference increased substantially at Condobolin. The yield of the fine wools was greater than that of the mediums at Armidale but this was reversed upon exposure to the Condobolin environment. The lower yield of the superfine and fine wools relative to the medium wools may be a function of the relative penetration of dust into the fleece although subjective assessment of dust penetration shows only small differences.

The clean fleece weight of each micron group increased in the new environment (Table 2). The increases between the Armidale and Condobolin shearings were 59, 80 and 100 % for the superfine,

fine and medium groups respectively. Despite these large increases in clean fleece weight, there were relatively small increases in average fibre diameter of 1.1, 1.6 and 2.6 μm for the superfine, fine and medium groups respectively. These changes in fleece weight per unit change in fibre diameter are massive compared with the genetic (Coelli *et al.* 1998) and environmental (Coelli, *et al.* 1999) regression estimates from the combined wether trial analyses. As this large change in wool production was associated with relatively small changes in fibre diameter and body size, it was surprising that there was little difference in staple length between the three environments, regardless of micron group. Therefore, there must then be some underlying change occurring at the follicular level to affect wool production and quality to such an extent.

The staple strength of the wethers at Armidale was, on average, about 10 N/ktex stronger than at the Condobolin shearings. There was no difference between the three micron groups at Armidale, nor at the Armidale x Condobolin shearing. However at subsequent Condobolin shearings the staple strength of the medium wools was higher than both the superfine and fine wools, which were not different to each other and not different to the Armidale x Condobolin shearing. This type of interaction was unexpected and clearly warrants further investigation.

In conclusion, translocation of fine and superfine Merino sheep to non-traditional environments, led to a dramatic increase in wool production accompanied by only relatively small changes in fibre diameter and virtually no change in staple length. The benefits of this are two-fold. Firstly, despite the increase in production, producers of superfine and fine wool in these environments will not suffer from price penalties for producing over length wools. Secondly, even though the yield and style of superfine and fine wool may suffer in non-traditional environments, this would be largely overcome by the additional production being achieved in Condobolin-type environments. Research aimed at improving the style of fine wools in these environments through using sheep coats is currently in progress. Indeed the results of this study lead one to wonder what is limiting the productivity of superfine and fine wools in the traditional tablelands environments.

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