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STYLE AND PRODUCTION CHANGES ACROSS AGES IN MERINO SHEEP

W.K. Murray[1] , S.I. Mortimer[1] , K.D. Atkins[2] , P.J. Taylor[2] and S.L. Anderson[1]

[1] NSW Agriculture, Agricultural Research Centre, Trangie, NSW 2823
[2] NSW Agriculture, Orange Agricultural Institute, Orange, NSW 2800

SUMMARY
Effects of age and reproductive performance on measured and visually assessed style traits were investigated for 2817 Merino ewes in the QPLU$ project. Phenotypic correlations between hogget production traits and adult style traits were also examined. Generally, style traits were repeatable across ages, although less so than for the measured traits. Correlations between production and style traits would indicate that selection for increased fleece weight and reduced fibre diameter will have little impact on measured and assessed style traits. This is a preliminary analysis and will be repeated as further data are collected.
Keywords: Merino, repeatability, wool production, style, age, reproductive status.

INTRODUCTION
While clean fleece weight and fibre diameter are the main determinants of price received by growers from Merino wool sales, there is increasing interest in style components in relation to processing performance and possibly price. As with fleece weight and fibre diameter, style traits are expressed several times throughout the life of an animal. There is a perception in the Merino wool industry regarding deteriorating changes in style with age and reproductive status. Work done by Mortimer and Atkins (1989) has described a significant effect of birth-rearing type on clean fleece weight and fibre diameter recorded on hoggets but this was unimportant for adult expressions of these traits (Atkins and Mortimer 1989). Significant changes in CFW and FD across ages have been reported by Atkins (1990) while Waters *et al.* (2000) observed significant effects of current reproductive performance on CFW and FD. Repeatabilities for these and some style traits have been estimated (Hatcher and Atkins 2000).

In this paper, we examine the effects of age and reproductive performance on production and style traits in Merino sheep, as well as the repeatability of these traits.

MATERIALS AND METHODS
Records from 2817 ewes from the Trangie QPLU$ project (Taylor and Atkins 1997), born between 1995 and 1998, were used. Records were collected from hogget and all adult shearings up to four years of age for each animal up until 1999 shearing. The number of records available decreased with each age group. For fibre diameter there were 2817 hogget, 1892 two year old (2YO), 995 three year old (3YO) and 395 four year old (4YO) records. Data were available for measured traits including fibre diameter (FD, μm), coefficient of variation of FD (CV, %), clean fleece weight (CFW, kg), staple length (SL, mm) and dust penetration (DP, mm). Visually scored traits included crimp frequency (CF, crimps/25mm), crimp definition (CD, 1-7), greasy colour (COL, 1-8), staple definition (SD, 1-6) and tip (TIP, 1-3), with the best scores recorded as 1.

Data on each trait were analysed using REG (Gilmour 1988). Least squares analysis of variance was used to fit sire, line, birthdate, birth-rearing type, dam age, year of measurement and first order interactions to hogget data and these effects as well as age (Hogget versus 2YO versus 3YO versus 4YO) and reproductive performance (no lambs born versus no lambs reared versus one lamb reared versus multiple lambs reared) to adult data for each trait. Non–significant effects ($p<0.05$) were sequentially deleted from the model for each trait. Least squares methods were used to estimate within-ewe repeatability by fitting a model including age, year, line, sire, ewe and year X line interaction to calculate sire variance (σ_S^2), between ewe variance (σ_B^2) and within ewe variance (σ_W^2). Repeatability was then calculated as $t = (\sigma_S^2 + \sigma_B^2)/(\sigma_S^2 + \sigma_B^2 + \sigma_W^2)$.

RESULTS

The averages for effects of age and current reproductive status on various style components are shown in Tables 1 and 2.

Table 1. Effect of age on wool production and style (standard errors in brackets)

	FD	CV	SL	DP	CF	CD	SD
Hogget	20.89	22.83	101.39	60.41	9.91	2.75	3.92
	(0.04)	(0.07)	(0.28)	(0.25)	(0.03)	(0.02)	(0.02)
2YO	21.41	21.04	103.62	64.68	10.83	2.88	3.93
	(0.08)	(0.14)	(0.56)	(0.56)	(0.11)	(0.08)	(0.06)
3YO	21.82	20.33	100.09	62.95	10.76	3.20	4.13
	(0.04)	(0.07)	(0.27)	(0.27)	(0.04)	(0.02)	(0.03)
4YO	21.92	20.22	99.39	62.61	10.53	3.44	4.14
	(0.09)	(0.15)	(0.62)	(0.61)	(0.11)	(0.08)	(0.06)

Table 2. Effect of reproductive status on wool production and style (standard errors in brackets)

Status	FD	CFW	SL	DP	CF	COL	SD	TIP
NLB	21.99	5.17	103.05	65.39	10.59	3.83	4.04	1.93
	(0.04)	(0.02)	(0.33)	(0.32)	(0.04)	(0.04)	(0.03)	(0.01)
NLS	21.74	4.99	101.35	63.99	10.64	3.86	4.02	2.00
	(0.05)	(0.02)	(0.36)	(0.35)	(0.05)	(0.04)	(0.03)	(0.02)
OLS	21.58	4.71	100.52	63.00	10.77	3.99	4.03	1.99
	(0.04)	(0.02)	(0.27)	(0.26)	(0.04)	(0.03)	(0.03)	(0.01)
MLS	21.56	4.56	99.21	61.25	10.84	3.94	4.19	2.02
	(0.06)	(0.03)	(0.43)	(0.42)	(0.05)	(0.05)	(0.04)	(0.02)

Generally the style traits studied deteriorated with age. However CFW, COL and TIP were not significantly affected (results not shown). CF was greatest at hogget age and then gradually decreased from 2YO for the life of the animal. As reproductive burden increased, wool style tended to deteriorate. The only significant exception to this was CF increasing with reproductive status. CV and CD were not significantly affected by reproductive status (results not shown).

For all measured traits and CF repeatabilities were all greater than 0.5 (Table 3). Generally, repeatabilities were lowest for visually scored traits (0.1 – 0.4). Correlations (Table 4) between hogget CFW and FD with all adult SL, DP and COL were moderate to highly positive while the correlations with CF were strongly negative. Correlations with CD, SD, TIP and CV were weak.

Table 3. Repeatability estimates for wool production and style (standard errors in brackets)

Trait	Repeatability	Trait	Repeatability
FD	0.74 (0.01)	CF	0.55 (0.01)
CV	0.63 (0.01)	CD	0.31 (0.02)
CFW	0.65 (0.01)	COL	0.41 (0.01)
SL	0.63 (0.01)	SD	0.28 (0.02)
DP	0.50 (0.01)	TIP	0.09 (0.02)

Table 4. Correlations between hogget CFW and FD and adult style traits

Trait	Hogget CFW			Hogget FD		
	2YO	3YO	4YO	2YO	3YO	4YO
SL	0.47	0.47	0.54	0.41	0.45	0.45
DP	0.44	0.44	0.56	0.28	0.27	0.36
CF	-0.61	-0.65	-0.67	-0.46	-0.52	-0.52
CD	0.06	0.14	0.12	0.09	0.21	0.20
COL	0.38	0.38	0.48	0.35	0.34	0.45
SD	-0.14	-0.10	-0.17	0.05	0.06	0.05
TIP	0.13	0.26	0.24	-0.10	0.11	-0.01
CV	-0.01	-0.02	-0.09	-0.02	-0.06	-0.14

DISCUSSION

This is a preliminary analysis of this data and will be repeated as further data are gathered. As more lifetime records are collected these estimates can be refined.

The effect of age on various wool traits was not unexpected with FD gradually increasing with age and CD and SD deteriorating slightly with age. It was interesting to note that CF increased with age and there was no significant effect of age on COL. CV decreased by about 3% from hogget to 4YO shearing. However care should be taken when interpreting this due to the poor correlation between hogget FD and CFW and adult style traits. While this study showed no significant age effect on CFW, this differs from the results of Atkins (1990) which showed age to have a significant effect.

Reproductive performance was quite predictable also with FD, CFW and DP deteriorating significantly as reproductive burden increased. While other traits were significantly affected, the changes would be difficult to discern in a practical situation. Interestingly though, CD was not significantly effected by reproductive status.

Repeatabilities for FD, CFW, SL, CD and COL are similar to those estimated by Hatcher and Atkins (2000) for fine woolled Merino sheep but the estimate for clean fleece weight was considerably

higher than that estimated by Manson *et al.* (1999) for strong woolled Merino sheep. There may in fact be strain differences in the repeatability which will be identified with further analyses. Repeatability for DP was significantly higher than the previous estimate. This may be due to this measurement being from the base and the earlier estimate being from the tip. In addition, the significance of age and reproductive status on DP supports the fact that variation in DP may be largely due to non-genetic factors as suggested by the low heritability estimates of 0.04 put forward by Hatcher and Atkins (2000) and 0.22 by Mortimer and Atkins (1993). The moderate to high repeatability estimates for all traits except for CD, SD and TIP indicate that hogget measurements for most traits should be valid indicators for lifetime performance. However, the relatively low values for both CD and SD mean that hogget performance for these traits would not provide reliable predictors of lifetime performance. This is significant for industry in that these style traits are very important in visually assessing style on the sheep's back.

The correlations between production and style traits indicate that for most selection programs aimed at increasing CFW and decreasing FD the net effect on adult style of selecting for production in hoggets should be minimal.

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REFERENCES

Atkins, K.D. (1990) *Proc. 4th Wld Congr. Genet. Appl. Livestock Prod.* **15**: 17.
Atkins, K.D. and Mortimer, S.I. (1989) *Final Report to the A.W.C.*, K/1/1065.
Gilmour, A.R. (1988) *NSW Agriculture Misc. Bull.1*, 3rd ed.
Hatcher, S. and Atkins, K.D. (2000) *Asian-Aus. J. Anim. Sci*., **13** Supplement A: 293.
Manson, D.A, Gallagher, J.R., Hynd, P.I. and Pitchford, W.S. (1999) *Proc. Assoc. Advmt. Anim. Breed. Genet.* **13**: 94.
Mortimer, S.I. and Atkins K.D. (1989) *Aust.J.Agric. Res.* **40**: 433.
Mortimer, S.I. and Atkins K.D. (1993) *Aust.J.Agric. Res.* **44**: 1523.
Taylor, P.J. and Atkins, K.D. (1997) *Wool Tech. Sheep Breed.* **45**: 92.
Waters, C.M., Coelli, K.A., Lee, G.J and Atkins, K.D. (2000) *Aust. J. Exp. Agric.* **40**: 931.