GENETIC PARAMETERS FOR PRODUCTION TRAITS IN QUEENSLAND MERINOS

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SUMMARY

Genetic and phenotypic parameters are presented for production traits, greasy fleece weight (GFW), yield (YLD), clean fleece weight (CFW), average fibre diameter (DIAM) and liveweight (LWT), in 15 month old medium Peppin Merino sheep at Longreach and Julia Creek, Queensland. Heritabilities for GFW, YLD, CFW, DIAM and LWT were respectively 0.35, 0.62, 0.34, 0.74, and 0.37 for Longreach and 0.23, 0.52, 0.20, 0.67 and 0.56 for Julia Creek. Most estimates were consistent with other reported values.

Keywords: Merino sheep, genetic parameters, wool characters, liveweight

INTRODUCTION

The productivity of sheep in the dry tropics is very low (Rose 1972; 1974) and much of this has been attributed to heat and the very seasonal pasture conditions (Moule 1956). A project was designed to identify the characteristics of sheep that may be better adapted to and more productive in this area. Data obtained were used to estimate the phenotypic and genetic parameters for a large range of wool, reproduction, body and physiological characters. These parameters may then be used in selection strategies for breeding sheep with improved efficiency and production. This paper presents estimates of parameters for the characters commonly used in sheep selection programs, for both Longreach and Julia Creek.

MATERIALS AND METHODS

Location and sheep. The sheep were located at two sites, Rosebank Research Station, Longreach and Toorak Research Station, Julia Creek, Queensland and were locally bred, mature age, medium Peppin ewes and rams bred in the area. At each site sheep were joined in November in 18 paddocks, each containing a single sire group of 35 ewes. Ewes were lambed in sire groups and progeny tagged and recorded by sire group and dam. However dams were not identified at Julia Creek in 1992. All male progeny were left entire. Data are presented for the period 1992-94.

Fleece measurements. All progeny were shorn in July with 12 months wool growth and mid-side samples taken from both rams and ewes. Greasy fleece weight (GFW), percentage yield (YLD), clean fleece weight (CFW), and average fibre diameter (DIAM) were measured from these samples. Liveweight (LWT) was recorded annually off-shears.

Statistical design. The design was the same at both sites. Ewes were allocated randomly to sires using stratification on age and liveweight. To maximise the number of sires for analysis and obtain at least 16 progeny for measurement, 18 different sires were used each year and replaced in the following year. Sires used at Julia Creek were used at Longreach in the following year. After three joinings 54 sire groups were available at each site for analysis. There were 1,785 progeny records available for GFW and CFW, 1,792 for LWT and 1,795 for YLD and DIAM. The very few triplets were grouped with twins.

Statistical analyses. Analyses were carried out using the program ASREML (Gilmour *et al.* 1995 and 1998) and the model: $y = X\beta + Z\mu + \varepsilon$

where y is a vector of observations

X is a design matrix for fixed effects β

site (Longreach, Julia Creek)

year (1992,1993,1994)

sex (male, female),

birth type (single, twin) and their interactions

Z is a design matrix for random effects $\mu \sim (0, \sigma^2 G)$

site.sire

site.dam

Residuals $\varepsilon \sim (0, \sigma^2 R)$

Table 1. Means for greasy fleece weight (GFW), yield (YLD), clean fleece weight (CFW), average fibre diameter (DIAM) and liveweight (LWT) of 15-month medium Peppin Merino sheep

Factors		*Site*	GFW (kg)	YLD (%)	CFW (kg)	DIAM (μm)	LWT (kg)
Year of birth	1992	*Longreach*	3.82	63.40	2.42	21.50	32.15
		Julia Creek[a]	-	-	-		
	1993	*Longreach*	4.49	62.71	2.80	22.46	41.21
		Julia Creek	3.11	64.90	2.01	21.01	33.97
	1994	*Longreach*	2.46	61.59	1.52	19.18	28.08
		Julia Creek	2.59	66.34	1.72	19.35	29.36
Sex	Male	*Longreach*	3.82	62.13	2.37	20.90	38.92
		Julia Creek	2.57	65.81	1.71	19.55	30.51
	Female	*Longreach*	3.36	63.00	2.13	21.19	28.71
		Julia Creek	2.86	65.40	1.86	20.72	28.31
Birth type	Single		3.26	64.19	2.09	-[b]	31.86
	Twin		3.04	63.99	1.94		31.36

[a] Dams were not identified at Julia Creek in 1992.

[b] There were differences between years for average fibre diameter. See Table 2.

Non-significant interactions of the fixed effects were dropped from the models. Heritabilities were estimated from univariate analyses with diagonal variance structure for site.sire and site.dam. Phenotypic and genetic correlations were estimated from bivariate analyses with unstructured variance for site.sire and diagonal variance structure for site dam.

RESULTS AND DISCUSSION

Effects of environmental factors. Table 1 presents the means for fleece characters and liveweight for each site and for each of the environmental factors, year of birth, sex and birth type and/or their significant interactions. There was a significant year of birth by site effect on all characters and there were very large differences between some years. Year of birth and year of measurement were confounded so differences reflect the season prevailing in the year of measurement. Sex by site was significant for all characters. Rams were heavier at 15 months and at Longreach they had heavier, lower yielding and finer fleeces. At Julia Creek rams had lighter, higher yielding and finer fleeces. Birth type had a smaller effect on each character and there were no differences between years except for average fibre diameter (Table 2).

Table 2. Effect of year by birth type on average fibre diameter (DIAM)

Birth type	1992	1993	1994
Single	20.3	21.7	19.0
Twin	21.2	21.7	19.5

Table 3. Phenotypic and genetic parameters for greasy fleece weight (GFW), yield (YLD), clean fleece weight (CFW), average fibre diameter (DIAM) and liveweight (LWT) of 15-month medium Peppin Merino sheep

		GFW (kg)	YLD (%)	CFW (kg)	DIAM (μm)	LWT (kg)
Mean		3.15	64.09	2.01	20.51	31.61
Heritability	*Longreach*	0.35±0.09	0.62±0.13	0.34±0.09	0.74±0.15	0.37±0.10
	Julia Creek	0.23±0.11	0.52±0.17	0.20±0.11	0.67±0.19	0.56±0.17
GFW	*Longreach*		0.10±0.07	0.79±0.01	0.18±0.03	0.31±0.03
	Julia Creek		-0.07±0.03	0.82±0.02	0.13±0.05	0.28±0.04
YLD	*Longreach*	-0.26±0.18		0.44±0.03	0.08±0.03	0.04±0.03
	Julia Creek	-0.27±0.25		0.25±0.04	0.03±0.05	-0.04±0.04
CFW	*Longreach*	0.65±0.11	0.53±0.14		0.20±0.03	0.29±0.03
	Julia Creek	0.71±0.14	0.53±0.19		0.15±0.04	0.21±0.04
DIAM	*Longreach*	0.40±0.16	0.14±0.16	0.47±0.15		0.08±0.03
	Julia Creek	0.39±0.23	0.10±0.20	0.43±0.19		0.03±0.05
LWT	*Longreach*	0.16±0.20	-0.25±0.18	-0.06±0.21	0.25±0.17	
	Julia Creek	0.53±0.19	0.28±0.21	0.20±0.20	0.01±0.22	

Phenotypic correlations are above the diagonal and genetic correlations below.

Phenotypic and genetic parameters. Table 3 presents the heritabilities and genetic and phenotypic correlations for each of the production characters. The estimates of heritability at both sites were all moderate to high and were within the published range for Peppin flocks (Turner and Young 1969; Mortimer 1987). Generally phenotypic correlation estimates were in agreement with published figures although that between GFW and YLD was low compared with other estimates for Peppin Merinos. All estimates of genetic correlations at both sites were consistent with reported values (Mortimer 1987).

CONCLUSIONS

This study shows that breeders in these areas may be confident of achieving genetic improvement of the important traits in their flocks. These estimates are consistent with the values used in Rampower (Brash and Rogan 1997). However production in the area is severely reduced by the ability of the sheep to reproduce and survive as well as the very seasonal availability of feed and high ambient temperatures. Management and husbandry practices which ameliorate the environment have been developed. However, the inclusion of other criteria in selection programs that may result in sheep that are better adapted to the environment may bring significant benefits.

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