

FLEECE STRUCTURE AND FLEECE ROT SUSCEPTIBILITY IN SOUTH AUSTRALIAN
MERINO SHEEP

P.J. James, R.W. Ponzone, J.R.W. Walkley, J.E. Stafford
Department of Agriculture, GPO Box 1671 Adelaide 5001

K.J. Whiteley
C.S.I.R.O. Division of Textile Physics, Ryde, 2112

Susceptibility to fleece rot and body strike is a major reason why high wool producing strains of Merinos such as South Australian Merinos are not used to a greater extent in high rainfall areas. Breeding more resistant sheep could provide a means of overcoming this limitation. As natural expression of fleece rot and body strike depends on seasonal conditions direct selection is difficult. Selection on the basis of indirect criteria highly correlated with resistance to fleece rot is a possible alternative in such circumstances (McGuirk *et al.* 1978). In this paper we report phenotypic and genetic parameters for fleece rot susceptibility, greasy wool colour and a number of attributes of fleece structure in South Australian Merinos. The potential value of these characters in breeding programmes is discussed.

MATERIALS AND METHODS

Observations were made on the ewe and wether progeny of 31 randomly selected rams from a stud of the Collinsville family group. The numbers of sires (progeny) observed in 1980, 1981, 1982 and 1983 were respectively 8 (202), 8 (209), 7 (154), and 8 (171).

Fleece rot was scored along the backline of each sheep by the method of James *et al.* (1983) at weaning (WFR), at age 9-10 months (NMFR) and prior to hogget shearing (HFR). In 1982, 1983 and 1984 after scoring for HFR, wether progeny were subjected to an artificial wetting regime (McGuirk *et al.* 1978) and fleece rot was scored (AWFR). A fleece rot score based on the area of the shorn fleece affected (SHFR) was also given by the wool classer at hogget shearing in 1981, 1982 and 1983. For analysis fleece rot was also expressed as incidence (WFRI, NMFRI, HFRI, AWFRI and SHFRI, coded 0 for absence and 1 for presence of fleece rot).

Prior to artificial wetting both the male and female progeny were scored for character (CHAR), handle (HDL) staple formation (SF), tip formation (TF), density (DENS) and colour (COL) with score 1 most favourable (James *et al.* 1983). At shearing, greasy fleece weights (GFW) were recorded and midside samples were collected. Fibre diameter (FD) was determined by the airflow method. The dirty tip was removed from the remainder of the sample and resistance to compression (RC) determined by the method of Whiteley *et al.* (1986). Standard

deviation of fibre diameter (SD) and average fibre diameter (SDIA) were measured with the CSIRO Fibre Diameter Analyser (Lynch and Mitchie 1976). CVD was calculated as SD/SDIA.

The data were analysed by least-squares analysis of variance. Heritabilities and phenotypic correlations were obtained from the between sire variance and covariance components. The general model fitted included years, sires nested within years, age of dam, type of birth and sex. Initially all two-way interaction terms were included in the model, but the final analysis included only those that were statistically significant ($P < 0.05$). Some characters were recorded in males only.

Table 1: Half sib heritability estimates (h^2) and standard errors (SE) for fleece rot and fleece characters in South Australian Merino sheep.

Variable	h^2	SE	Variable	h^2	SE
GFW	0.36	0.14	WFR	0.16	0.10
FD	0.46	0.16	WFRI	0.21	0.11
SD	0.53	0.17	NMFR	0.08	0.08
CV	0.57	0.17	NMFRI	0.12	0.09
RC	0.55	0.17	HFR	0.13	0.09
HDL	0.45	0.15	HFRI	0.12	0.09
CHAR	0.29	0.12	SHFR	0.0	0.05
SF	0.25	0.11	SHFRI	0.13	0.10
TF	0.30	0.13	AWFR	0.0 [†]	0.11
DENS	0.39	0.14	AWFRI	0.0 [†]	0.09
COL	0.42	0.15			

[†] Calculated from the wether progeny only. Estimates were slightly negative, set at zero for presentation.

Table 2: Phenotypic correlations between fleece rot score and incidence and fleece characters in South Australian Merino sheep.

	WFR	WFRI	NMFR	NMFRI	HFR	HFRI	SHFR	SHFRI	AWFR [†]	AWFRI [†]
GFW	0.04	0.09*	-0.03	0.02	0.06	0.09*	0.05	0.00	0.04	0.09
FD	-0.11*	-0.09*	0.01	-0.01	0.00	0.00	-0.03	-0.03	0.07	0.04
SD	-0.03	0.01	-0.02	0.02	0.04	0.06	0.11*	0.09	0.19	0.09
CVD	0.03	0.03	0.00	0.02	0.06	0.09*	0.14*	0.12*	0.14*	0.03
RC	-0.11*	-0.13*	-0.02	-0.04	-0.05	-0.05	-0.06	-0.06	-0.03	-0.04
HDL	-0.01	-0.02	0.04	0.05	0.15*	0.11*	0.15*	0.14*	0.29*	0.20*
CHAR	-0.07	-0.05	-0.03	-0.02	0.05	0.05	0.06	0.04	0.19*	0.16*
SF	0.09*	0.06	0.07	0.05	0.00	-0.02	-0.07	-0.04	-0.15*	-0.13*
TF	0.06	0.08	0.10*	0.08	0.03	0.00	-0.01	0.00	-0.08	-0.05
DENS	0.02	0.04	-0.04	-0.04	-0.10*	-0.11*	-0.09	-0.09	-0.12	-0.10
COL	0.18*	0.16*	0.11*	0.09*	0.28*	0.23*	0.20*	0.17*	0.24*	0.26*

[†] wether progeny only. * $P < 0.05$

RESULTS AND DISCUSSION

Heritability of fleece rot and fleece characters

The heritabilities of fleece rot incidence and score in the field at various ages were similar and varied from 0.08 for fleece rot score at nine months to 0.21 for fleece rot incidence in weaners (Table 1). However, heritability estimates of all or none traits such as fleece rot are incidence dependent and in this experiment the fleece rot incidence was low (0.18 for WFRI, 0.05 for NMFRI and 0.19 for HFRI). When the estimates were adjusted for incidence on the liability scale (Falconer 1981), the values were 0.45 at weaning, 0.53 at nine months and 0.25 in hoggets. This is of similar magnitude to that estimated for Peppin Merinos (0.4, McGuirk and Atkins 1984). Despite the high incidence of fleece rot after wetting (AWFRI = 0.50), the estimate of its heritability was disappointing. However, it should be noted that it was obtained from only 23 sires with an average of 13 progeny per sire.

Previous estimates of heritabilities for fleece characters in South Australian Merinos have been obtained from flocks of the Bungaree family group (see Gregory 1982). The estimates from the Collinsville family group in the present work are generally of similar magnitude (Table 1). The heritability of RC was high although lower than that obtained in Peppin Merinos (0.8, Watson *et al.* 1977). SD and CVD also had high heritabilities as was the case in Peppin Merinos (K.J. Whiteley pers. comm.).

Phenotypic correlations with fleece rot

Greasy wool colour was the character most strongly related to fleece rot in this study (Table 2) and has also been the most consistently related character in past studies (Holdaway and Mulhearn 1934, Belschner 1937, McGuirk and Atkins 1980). Though other characters, mainly related to suint content, have been correlated with fleece rot susceptibility (Lipson *et al.* 1982), these are frequently correlated with wool colour (James *et al.* unpublished) and often do not improve the accuracy of prediction of fleece rot susceptibility above that offered by colour alone (James *et al.* 1983). The strong relationship between fleece rot susceptibility and CVD in Peppin Merinos (Watts *et al.* 1980, 1981) suggested an additional character, unrelated to colour, which could be of use in selection programmes to increase fleece rot resistance. In our experiment the correlation of CVD with liability to fleece rot as hoggets in the field was 0.13. This is substantially below the value of 0.66 estimated in Peppin Merinos by Evans and McGuirk (1983) and of that for colour which was 0.33 our experiment. Lipson *et al.* (1982) found that CVD was related to fleece rot susceptibility in only 6 of 14 flocks that they studied.

Tip formation was not correlated with fleece rot incidence in our study and had a correlation of -0.16 with CVD. This differs from findings with Peppins in which the staple tips of more resistant sheep were more consolidated and less pointed in outline than those of susceptible sheep (Watts *et al.* 1981). Both staple formation and character were correlated with CVD ($r = -0.22$ and $r = 0.20$) and were associated with fleece rot following artificial wetting (Table 2). Handle was the most strongly correlated of all of the fleece structure characters examined and was moderately heritable. However, as with

other studies, the correlation was not high (Paynter 1961, McGuirk and Atkins 1980). No correlation was found between CVD and COL ($r = 0.03$) while the correlation between COL and HDL was 0.32. These correlations suggest that CVD and HDL may contribute to the prediction of fleece rot susceptibility when used in combination with greasy wool colour.

The positive correlation between greasy fleece weight and fleece rot susceptibility was low (Table 2). Therefore it should be possible to simultaneously increase both fleece rot resistance and fleece weight.

The heritabilities estimated in this paper show that genetic gains in fleece rot resistance can be expected in South Australian Merinos if appropriate breeding strategies are followed. Greasy wool colour presently remains the single most useful indirect criterion for increasing fleece rot resistance in South Australian Merinos. However, if the genetic correlations are shown to be of similar magnitude to the phenotypic correlations estimated in this paper, it seems likely that CVD and HDL may contribute to the prediction of fleece rot susceptibility when combined with colour in a suitably weighted index.

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