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A COMPARISON OF DAMARA CROSSBRED AND MERINO LAMBS WOOL

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SUMMARY

Lambs wool production and qualities from the progeny of 2 Merino and 2 Damara rams mated to Merino ewes were compared. The crossbred lambs produced about half the amount of wool and had high fibre diameter variation and medullated fibre components. Merino lambs wool was contaminated with pigmented and medullated fibres apparently transferred from continual exposure to the Damara crossbred lambs; supporting the requirement for specific labelling ("Y" suffix) to make buyers aware. Wool production declines, restrictive crossbred wool qualities and wool contamination (including effects on the maternal fleece) reduce wool income during crossbreeding and need to be considered in the diversification to a woolless sheep enterprise.

Keywords: Damara Merino, lambs wool

INTRODUCTION

The Damara sheep breed was imported to Australia from South Africa by various private entrepreneurs, following a review by the Agricultural and Research Management Council of Australia (ABARE 1995), using quarantine protocols developed for frozen embryos (AQIS 1996). The Damara is a fat tail breed that sheds its coat (Du Toit 1995) providing a diversification to stock that are preferred by middle east live sheep export markets and with potential low costs of flock maintenance. The high cost of purebred Damara sheep lead to most developing flocks undertaking crossbreeding with Merinos. Effective fleece shedding is, however, only restored in Damara comebacks. Damara first cross lambs require shearing and crutching and this involves costs and production of unusual wool. There is little information available about the production and qualities of Damara first cross wool that determine the value of this product and income relative to Merino lambs wool. It is important for those considering the Damara option or valuing the wool produced to be aware of the qualities found for examples of the products involved. A study of Merino wool contamination arising with Damara crossbreeding (Fleet *et al.* 2001*a*) provided an opportunity to collect data about the wool from some of the Merino and Damara crossbred lambs produced. Wool production and washing yield, fibre diameter, curvature, medullation, staple length and strength for these Merino and Damara crossbred lambs are compared. In addition, the pigmented and medullated fibre contamination found in the Merino lambs wool is reported.

MATERIALS AND METHODS

Experimental animals

Born in 1999 at Minnipa Agricultural Centre (Eyre Peninsula, SA), the lambs were male progeny of 2 Merino and 2 Damara rams mated to Merino ewes as previously described (Fleet *et al.* 2001*a*; Fleet *et al.* 2002). The 27 Merino lambs had entirely white coats mainly with low levels of halo-hair fibre. In contrast, the 26 Damara crossbred lambs had hairy tan coloured coats with various levels of white spotting. Merino and crossbred lambs were born in separate groups, were tagged and mothered soon after birth, and were run together from lamb marking (age < 6 weeks) until sent to the abattoir (7-months of age). Extensive paddock conditions applied except for the last 8 weeks when in a feedlot. Lambs wool was harvested from the skins following slaughter.

Measurements

Wool shorn from skins (including the mid-side sample) was weighed. The Merino fleeces were each spread over a table and grid sampled (perspex sheet with 8 x 13 holes). These samples were then aqueous (Lissapol) washed and a 10 g sub-sample of the scoured staples inspected for pigmented and medullated fibres (Fleet *et al.* 2001*a*). From the mid-side sample wool, 10 staples were taken for measurement of staple length and strength. The mid-side wool was mini-cored and these fibre snippets solvent (Trineu) scoured and 40 g of the mid-side wool aqueous scoured and dried to obtain a washing yield. Staple length of each staple was measured manually while staple strength and position of break were measured with the Agritest Staple Breaker system. Mini-core fibre snippets from the mid-side sample wool were measured for fibre diameter, curvature and medullation by OFDA100(www.ofda.com.au). The slides of snippets for the Damara crossbred lambs were inspected for content of tan fibre and classified as present and obvious or evident to a minor degree. The snippets slides were also inspected with a dissection microscope to inspect individual fibres. Medullation was accepted for fibre diameter > 20μm and opacity ≥ 80%. Objectionable medullated fibres had fibre diameter > 25 μm and opacity ≥ 94%. Flat medullated fibres had opacity < 80%, wide light band width > 40 μm and fibre diameter > 60 μm (IWTO-57-98).

Statistical analysis

Due to the limited number of rams involved the analysis for a breed comparison is not adopted. The model used for the least squares analysis of variance (procedure GLM of SAS 1996), for lambs wool production and qualities (Table 2), included ram (Merino 1 and 2 and Damara 1 and 2), rearing status (single or multiple reared) as the main effects, the interaction between ram and rearing status and day of birth as covariate. The effect of obvious v. minor presence of pigmented fibres, on the OFDA100 medullated fibre measurements from the Damara crossbred wool, was also analysed using fibre diameter and standard deviation of fibre diameter as covariates.

RESULTS

Inspection of the scoured Merino grid sample wool revealed high concentrations of pigmented and heavily medullated fibres (Table 1). Of the 1085 classified pigmented and heavily medullated fibres extracted from the Merino lambs wool 604 (56%) had intact tapered tip and remnant root bulb and 349 (32%) had remnant root bulbs; typical of shed fibres. Of the 829 pigmented fibres extracted, 784 (95%) had pronounced medulla exceeding 50% of the fibre diameter.

Table 1. Contaminated Merino lambs wool

	Mean number (± s.d.) per 10 g scoured staples	
Length of fibres (mm)	Pigmented fibres	Heavily medullated white fibres
3 - 10	11.6 (5.7)	3.5 (2.0)
11 - 25	10.1 (4.6)	3.8 (3.1)
> 25	8.7 (6.1)	2.4 (1.7)
Total	30.4 (12.3)	9.4 (3.9)

Means and standard errors for fleece weights and wool qualities of the progeny of the four rams are shown in Table 2. Significant effects (P<0.05) for ram group were found between all characters except washing yield (P=0.11). Rear status (P<0.001) and birthday (P=0.004) were important for greasy fleece weight but not significant (P≥0.05) for all other wool characters. The interaction between ram and rear status was not significant in all cases. Effect of obvious v. minor presence of pigmented fibre in the snippet samples, on the OFDA100 medullated fibre measurements of the Damara crossbred samples, was not significant (P>0.05) after using mean fibre diameter and standard deviation of fibre diameter as covariates.

Table 2. Fleece weights and wool quality means (±s.e.) of the progeny of 2 Damara and 2 Merino rams

Character	Merino 1	Merino 2	Damara 1	Damara 2
1 Greasy fleece kg	2.28 (0.10) a	2.20 (0.09) a	1.05 (0.09) b	1.16 (0.09) b
2 Staple length mm	59 (2.1) a	50 (1.8) b	50 (1.9) b	54 (1.8) ab
3 Staple strength N/tex	26 (1.3) a	27 (1.1) ab	30 (1.2) bc	31 (1.2) c
4 Broken tip portion %	56 (1.8) a	55 (1.5) a	47 (1.6) b	43 (1.6) b
5 Fibre diameter FD μm	19.0 (0.40) a	19.8 (0.34) ab	20.4 (0.36) b	21.5 (0.35) c
6 Standard deviation FD %	3.4 (0.59) a	3.9 (0.50) a	8.5 (0.53) b	11.7 (0.52) c
7 Coefficient of variation FD %	18.2 (2.6) a	19.7 (2.2) a	41.6 (2.4) b	54.5 (2.3) c
8 Spinning fineness μm	18.0 (0.97) a	19.1 (0.83) a	24.7 (0.88) b	30.1 (0.86) c
9 Comfort factor %	99.5 (0.34) a	98.6 (0.29) a	96.5 (0.30) b	95.0 (0.30) c
10 Curve C degrees/mm	72.5 (2.5) a	81.1 (2.1) b	81.7 (2.2) b	80.9 (2.2) b
11 Standard deviation C %	49.0 (1.5) a	56.4 (1.3) bc	53.7 (1.4) b	53.0 (1.4) abc
12 Medullated diameter M μm	25.0 (2.4) a	26.6 (2.0) a	51.8 (2.1) b	61.4 (2.1) c
13 Standard deviation M %	6.8 (1.6) a	9.5 (1.3) a	25.8 (1.4) b	34.3 (1.4) c
14 Coefficient of variation M %	26.3 (3.8) a	35.0 (3.2) a	50.0 (3.4) b	56.2 (3.3) b
13 Medullated fibres / 10K	37 (25) a	43 (21) a	305 (22) b	416 (22) c
14 Flat medullated fibres / 10K	0.1 (1.5) a	0.2 (1.3) a	10.0 (1.3) b	10.8 (1.3) b
15 Objectionable medullated/10K	0.1 (10.2) a	0.0 (8.7) a	78 (9.2) b	136 (9.0) c

a,b,c Means in the same row with a different letter are significantly different (P<0.05)

DISCUSSION

The Merino lambs wool had high concentrations of pigmented and medullated fibres that had characteristics expected for shed fibres from Damara crossbred lambs (Fleet *et al.* 2001 *a, b*). Merinos without visible pigmented fibre on the coat have been found to have low concentrations of isolated pigmented fibres (Fleet *et al.* 1995). Pigmented fibres restrict the flexibility of end-use for sensitive white and pastel products and reported tolerances for Merino wool range between 1 and 100 dark fibres per kg of top (Foulds *et al.* 1984). White fibres with pronounced medullation (kemp) can also restrict end-use due to poor dye uptake of these fibres (ITWO-57-98). This report provides further support to the requirement in the Code of Practice that Merino wool continuously exposed to coloured or kempy sheep be branded with the "Y" suffix in order that wool buyers be made aware of the potential contamination (AWEX 2001).

While the results presented cannot be claimed as indicating general breed trends, due to the limited sampling involved, this case study provides some preliminary guidance about first cross Damara lambs wool. Progeny of the Damara rams produced about half the amount of wool compared to the Merino groups; though there was not a consistent relationship with the differences in staple length and mean fibre diameter. Differences in follicle populations were not measured but could also contribute to the differences in wool production between progeny groups (Hynd 1995). For fibre curvature, the progeny mean of one of the Merino rams was different from the progeny of the Damara rams. The Damara progeny groups had less tip percentage above the staple break and higher staple strengths and than both Merino groups. These findings could possibly be due to the 'wispy' tips, with increased tex occurring toward the base (reflecting the developing secondary wool fibre population), despite positioning of the jaws of the staple breaker lower down the tip region of the crossbred lambs wool.

It was the variance and medullation components of the fibre diameter distributions for which there were large differences between the progeny of the Merino and Damara rams. The standard deviation and coefficient of variation of fibre diameter for the Merino ram progeny were not different. In contrast, the Damara ram groups were different and standard deviations or coefficients of variation were between 2 and 3-fold greater than the Merino progeny groups. Spinning fineness was markedly increased as a result of the high standard deviations of fibre diameter of the Damara crossbred lambs wool; for Damara ram 2 the effective increase in fineness was 40%. Percentage of coarse fibres ($\geq$ 30µm), as indicated by the comfort factor, was similarly increased in the progeny of the Damara rams.

It was a concern that obvious tan fibre in some of the Damara crossbred samples might bias the medullated fibre measurement (IWTO-57-98). Where opacity changes caused by pigmentation or other colouration overlap the limits specified for medullation there could be potential for confounding. However, analysis did not find a significant effect from the obvious presence of pigmented fibre after adjustment for fibre diameter and standard deviation of fibre diameter. Most of the pigmented fibres extracted from the contaminated Merino lambs wool had pronounced medulla. It could be that the potential bias was reduced because of the medullation parameters used and, or, if the pigmented fibres evident in the snippet samples were also medullated while secondary wool fibres were not medullated or coloured to extent of overlap for opacity. From inspection of the snippets slides using a dissection microscope it appeared that the finer fibres were predominantly not pigmented nor heavily medullated while the very coarse fibre was predominantly pigmented and, or, heavily medullated. Such pigment patterns can be classified as Roan and is likely explained by restriction of pigment cell locations in skin during development; being absent from areas of epidermis and, or, the sites of secondary follicle initiation (Fleet 1997).

Progeny of both Merino rams had similar statistics for medullated fibres. In contrast, both Damara ram groups were higher than Merino groups for each of these measurements and also different for the crossbred groups except for flat fibres / 10K and coefficient of variation of medullated fibre diameter. Medullated fibre diameters were about double, and standard deviation of medullated fibre diameter between 3 to 5-fold, the Merino lamb groups. Total number of medullated fibres per 10,000 snippets is less relevant than the number of objectionable medullated fibres which are most likely to restrict dye uptake and present problems for sensitive end-uses (IWTO-57-98). The groups of crossbred lambs wool contained a high proportion of objectionable medullated fibre (0.78% and 1.36%) which is a direct effect of the Damara genetics.

Despite the high levels of medullated fibres (pigmented and white fibre of Damara origin) found in the Merino lambs wool by inspection with the CSIRO Dark Fibre Detector there were relatively few found by OFDA100 analysis. This apparent lack of detection by OFDA100 involves sampling limitations and fibre type differences. The staple inspections found about 40 pigmented and white medullated fibres per 10 g sample of which about 95% had a pronounced medulla (> 50% of the fibre diameter) but most were short fibres. On the basis of 20 million fibres per kg of scoured staple wool there is 200,000 represented in a 10 g sample. Therefore, a single OFDA count of 10,000 snippets might detect 5% (or 2) of the contaminant fibres found by CSIRO Dark Fibre Detector if there was a direct relationship with objectionable medullated fibre.

The implications of Damara crossbreeding on wool quality include effects on the maternal fleeces (Fleet *et al.* 2001*a,b*), other Merino wool exposed continuously and the crossbred wool. Contaminated white Merino wool may be heavily discounted with a recent specific quotation (G. N. Keynes, pers. comm.) being of the order of 20% while Pattinson and Hanson (1993) reported that discounts of up to 50% can apply. The recognition and appraisal of the increased quantities of such contaminated Merino wool and analysis of market prices will lead to better estimates of the range of penalties being applied in the auction system. Quoted values for Damara crossbred wool vary widely (from no value to $2.70 per kg) in part because of the unusual qualities, small quantities and lack of established markets. Clearly the presence of dark and, or, medullated fibre, together with coarse fibre and high fibre diameter variability, present limitations for potential applications and these explain the general reluctance of purchase and low quoted prices. Wool is usually an important part of the sheep enterprise income. However, in the divergence to a woolless sheep breed this income is progressively reduced and, in the start, the costs associated with shearing and crutching remain.

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REFERENCES

ABARE (1995).'An economic assessment of the introduction of the Dorper and Damara sheep breeds into Australia'. ABARE report prepared for the Agricultural and Research Management Council of Australia and New Zealand (ARMCANZ) pp 1-4.

AQIS (1996) 'Quarantine requirements for the importation of Ovine and Caprine embryos from the Republic of South Africa', 12 November T96/2405 (Australian Quarantine and Inspection Service, Department of Primary Industries and Energy; Canberra).

AWEX (2001). 'Code of Practice for the AWEX Quality System - preparation of Australian wool clips' (Australian Wool Exchange Ltd; Sydney)

DU TOIT CM (1995). 'The Damara sheep in South Africa'. (Damara Sheep Breeders' Association; Bloemfontein, South Africa).

FLEET, M.R., MORTIMER, S.I., HYND P.I., GALLAGHER, J.R. (1995). *Aust. Assoc. Anim. Breed. Genet.* **11**, 318-322.

FLEET, M.R. (1997). 'The inheritance and control of isolated pigmented fibres in Merino sheep', M. Agric. Sci. Thesis, Dept. Animal Science, University of Adelaide.

FLEET, M.R., TURK, J.A., COTTELL, M.A. and KEYNES, G.N. (2001a). *Aust. J. Exper. Agric.* **41**, 725-731.

FLEET, M.R., MAHAR, T.J. and DENNEY, S.I. (2001b). International Wool Textile Committee, Technology and Standards Committee, Nice Meeting, Report No. CTF02 p 1- 6.

FLEET, M.R., BENNIE, M.J., DUNSFORD, G.R., COOK, G.R. and SMITH, D.H. (2002). *Aust. J. Exp. Agric*. **42**(8), in press.

FOULDS, R.A., WONG, P. and ANDREWS, M.W. (1984). *Wool Technol. Sheep. Breed.* **33**, 91-100.

HYND, P.I. (1995). *Wool Technol. Sheep Breed.* **43**, 15-24.

PATTINSON, R. and HANSON, P. (1993). 'An assessment of risk factors associated with dark fibre within the Australian wool clip'. (Australian Wool Corporation; Melbourne).

IWTO (1998). 'Determination of medullated fibre content of wool and mohair samples by opacity measurements using an OFDA'. IWTO-57-98 (The Woolmark Co; Ilkley, UK).

SAS (1996) 'SAS System for Windows version 6.12' (SAS Institute Inc.; Carey, NC, USA).

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