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Dark fibre content of some New Zealand export wool consignments

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ABSTRACT

Levels of dark fibre contamination were determined on 49 core samples of scoured wool, representing 30 export consignments of crossbred wool received from three exporting companies. The concentrations of dark fibres ranged from 0 to over 3300/kg. Only four consignments contained less than 100 dark fibres/kg, twelve contained less than 500/kg, while four contained more than 2000/kg. The two highest levels of contamination (>2300/kg) were found in consignments containing lambs wool, although other consignments with lambs wool contained relatively low levels (<500/kg). Some fleece blends also contained relatively high levels of contamination (>1000/kg). All consignments containing down fleece wool were contaminated with dark fibres to levels which were highly correlated with the proportions of down fleece wool. Overall, 53% (range 7-100%) of the dark fibres found were melanin pigmented, 14 % (range 4-33%) were urine stained and 25% (range 5-63%) were of foreign origin. The results indicate that there is a considerable degree of dark fibre contamination in some export consignments of New Zealand crossbred wool. The one single factor consistently associated with increased levels of contamination was the presence of down fleece wool in the blend. The presence of lambs wool was associated with high levels of contamination in some consignments, but not in others. This suggests that only some lines of lambs wool contain high levels of dark fibre contamination.

Keywords: Wool; dark fibres; lambs wool; down wool; melanin pigmented; urine stained.

INTRODUCTION

The presence of dark fibres in wool export consignments is creating considerable concern in the wool industry, particularly in the production of Shetland knitwear, where lambs wool is used extensively. It has been suggested that increased use of terminal sire breeds - often black-faced breeds - is contributing to this increase in dark fibre contamination (Whall and Marshall, Personal Communication). However, there are several types of dark fibres in wool (Fleet, 1996; Foulds, 1985) and different techniques are required to reduce the presence of the different types. Few, if any, studies have been carried out describing the dark fibre content of New Zealand wools. This paper describes the concentrations and types of dark fibres present in a number of samples of wool from export consignments.

MATERIALS AND METHODS

Core samples of 30 export consignments of scoured crossbred-type wool (fibre diameter range 33.7-38.4 μm) were obtained from three wool exporting companies. Multiple samples were supplied from six consignments, where each sample represented one shipping container load. In all, dark fibre concentrations were determined on 49 samples. One wool exporting company provided samples of consignments which were known to contain lambs wool, which could have been contaminated with dark fibres, as well as some which did not contain lambs wool. The proportion of different wool types making up each consignment was provided for 28 consignments.

Each sample was sub-sampled to provide 100 g of wool for examination. This sub-sample was carded twice

through a WRONZ Core card to provide a stable thin web of wool to examine. After conditioning overnight, the numbers of dark fibres in five sequential weighed sub-samples (10 g) of this web were counted using a CSIRO Dark Fibre Detector based on IWTO(E)-13-88(E). After counting, up to 25 dark fibres (range 0-25) were removed at random from the 10 g sub-samples of each web to determine their origin. Dark fibres were classified by examining them under a microscope at 40 x magnification. "Pigmented fibres" contain granules of melanin, whereas "urine staining" is of relatively uniform intensity throughout the fibre (Foulds, 1983). A number of fibres had a coating of granules of dirt and these were classified as "dirty". Non-wool fibres were classified as "foreign".

Statistical analysis

As the numbers of dark fibres in sub-samples of the same sample were highly variable, the counts were transformed to square roots for statistical analysis. Differences between export consignments and between consignments containing lambs wool and other consignments were examined by analysis of variance of the transformed data using the 10 g sub-samples (and the sub-samples of each consignment, where applicable) as replicates using Genstat (Lawes Agricultural Trust, 2000). The samples from the consignments that were known to contain lambs wool were classed as "Suspect". The other samples from that exporter were classed as "Control". Samples from the other two exporting companies were classed as "Other". Three LSDs are reported because of the varying levels of replication between the different consignments.

RESULTS

The processing properties for the consignments examined are given in Table 1.

TABLE 1: Processing properties of export wool consignments examined.

Property	Minimum	Mean	Maximum
Fibre diameter (µm)	33.7	36.0	38.4
Yellowness (Y-Z)	-0.6	2.3	6.0
VM (%)	0.0	0.10	0.24
Length (mm)			
Hauteur	47	67.9	92
Barbe	60	90.9	117.5

The numbers of dark fibres observed are presented in Table 2. Levels of dark fibre contamination ranged from 0 to over 3300/kg. Only four consignments contained less than 100 dark fibres/kg, twelve contained less than 500/kg, while four consignments contained more than 2000/kg. Two of the consignments known to contain lambs wool contained among the highest levels of contamination (>2300/kg), while other consignments with lambs wool contained relatively low levels (<500/kg). Some of the blends consisting of fleece wool also contained relatively high levels of contamination (>1000/kg). For those consignments containing down fleece wool the level of dark fibre contamination (as square root of the dark fibre concentration) was correlated with the proportion of down fleece present ($r = 0.86$ $P < 0.05$, $n = 6$). Correlations between the square root of the dark fibre concentration and the proportions of lambs wool (or lambs slipe wool) ($r = -0.32$ ns, $n = 6$) or oddments ($r = 0.13$ ns, $n = 14$) were not significant.

Overall, 53% of the dark fibres found were melanin pigmented. Apart from one sample with a low level of contamination with dark fibres (16 dark fibres/kg, consignment 3), all of which were melanin pigmented, in most samples 30-74% of the dark fibres present were melanin pigmented. On average 14% (range 4-33%) were urine stained and 25% (range 5-63%) were of foreign origin (Table 3). There were no significant correlations between the proportions of any type of contaminant fibre present and the composition of the consignments.

DISCUSSION

The results indicate that there is a considerable degree of dark fibre contamination in some export consignments of New Zealand crossbred wool. The factor consistently associated with increased levels of contamination was the presence of down fleece wool in the blend. The presence of lambs wool was associated with high levels of contamination in some consignments, but not in others.

TABLE 2: Dark fibre concentrations in export consignments from three exporters.

Consignment	Type	Dark fibre concentration (kg)		
		SQRT ¹	Back ²	
1	Other	0.0	a	0
2	Other	2.8	ab	8
3	Control	4.0	abc	16
4	Other	9.6	abcd	93
5	Other	10.8	abcdef	116
6	Other	12.9	abcdefg	166
7	Other	15.3	bcdefgh	235
8	Other	16.8	bcdefgh	283
9	Suspect	18.9	cdefgh	359
10	Other	20.3	defghi	411
11	Control	21.1	defghi	445
12	Suspect	21.3	defghi	455
13	Other	22.4	defghij	503
14	Other	22.6	defghij	512
15	Suspect	23.4	defghij	548
16	Suspect	25.5	efghij	651
17	Other	26.4	fghij	696
18	Other	27.4	fghijk	750
19	Other	27.9	fghijk	780
20	Other	29.3	ghijk	858
21	Other	30.6	ghijk	936
22	Other	31.9	hijk	1017
23	Other	34.3	ijkl	1179
24	Control	36.9	kl	1365
25	Control	39.3	kl	1543
26	Other	42.1	klm	1769
27	Suspect	48.8	lm	2386
28	Suspect	54.5	mn	2976
29	Other	57.7	n	3327
30	Other	57.7	n	3332
LSD ³		i.	15.3	
		ii.	11.7	
		iii.	6.2	

In this table means with different superscripts differ significantly ($P < 0.05$)

1. Square root transformed mean
2. Back transformed from square root
3. Three LSDs are reported because of the varying levels of replication between the different consignments. Least significant differences between:
 - i. All except 12,15,27,28
 - ii. (12,15,27,28) and the rest
 - iii. 12,15,27,28

depending on the numbers of samples in each consignment.

Table 3: Types of dark fibres present in export wool consignments.

Consignment	Pigment	Type of dark fibre (%)		
		Stained	Dirty	Foreign
1	0	0	0	0
2	33	33	0	33
3	100	0	0	0
4	43	0	0	57
5	43	14	14	29
6	43	0	0	57
7	33	8	8	50
8	25	13	0	63
9	60	13	0	27
10	19	19	13	50
11	40	7	0	53
12	51	28	0	21
13	16	20	36	28
14	7	47	13	33
15	46	17	9	28
16	74	0	1	25
17	32	14	9	45
18	36	27	23	14
19	48	4	8	40
20	29	17	17	38
21	64	9	9	18
22	48	10	5	38
23	40	25	30	5
24	30	13	26	30
25	39	13	29	19
26	46	13	4	38
27	64	11	8	16
28	56	10	3	31
29	52	13	4	30
30	52	40	0	8

The relatively recent introduction into New Zealand of a number of new, ostensibly white wool breeds of sheep, such as the Texel, Finn, and East Friesian has added to the mix of maternal breeds. Of these, Texels are known to have relatively high levels of dark fibre contamination (Reid and Urquhart 2001), but nothing is known about the effect of the other breeds on this attribute.

Studies in Australia have shown that the proportions of melanin pigmented fibres in a fleece depend on the age and breed of the sheep (Fleet *et al.*, 1990; 1991). Running sheep with low levels of dark fibre contamination alongside sheep with black or highly contaminated fleeces may increase levels of dark fibre contamination (Fleet *et al.*, 2001; 2002a, 2000b; Hatcher *et al.*, 1999; 2000a, 2000b). These reports showed that the practice of using black-faced breeds as terminal sires over Merinos was likely to result in increased dark fibre contamination in the Merino wool if the ewes were shorn after lambing.

Urine stained fibres present around the crutch of ewes are spread throughout the fleece during shearing.

The concentrations of urine stained fibres in fleeces from ewes is higher than in fleeces from wethers (Foulds *et al.*, 1984), because of differences between the sexes in the way urine stained wool is removed during shearing. The extent of urine staining can also be dramatically reduced by crutching within three months before shearing (Foulds, 1989). Some of the foreign fibres may have entered the wool from dogs used to move the sheep, as they are forced into the shearing shed, or from the clothes of wool handlers.

The limits for dark fibre contamination of fine wools are very strict (<100 fibres/kg). The penalties for the presence of dark fibres in wool export consignments of strong wool, such as those examined in this trial, are less strict than those applying to fine wools. However, markets for wool contaminated to the high levels observed in this project are limited and therefore price penalties are likely to exist. Therefore, care needs to be taken in selecting rams and breeds to use, as well as in paying attention to the timing of crutching and shed cleanliness to reduce these high levels of dark fibre contamination.

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