RANDOM SPOT AND RELATIONSHIP WITH OTHER PIGMENTATION ON MERINOS

M. R. Fleet

SARDI, Turretfield Research Centre, Rosedale, SA 5350

SUMMARY

Pigmented fibres in white wool can limit flexibility of end-use but greasy wool cannot be measured presale for this fault. One source of pigmented fibres that continues to be a nuisance for sheep breeders is random spot. From an experiment involving study of isolated pigmented wool fibres, records on random spot were examined for relationship with other visible pigmentation. The study involved four hundred Merino ewes, with or without pigmented hairs on the legs, that were mated to rams with (n=9) or without (n=6) pigmented leg hairs. Presence and absence of pigmented leg hairs and random spot were positively associated (P<0.001). Among the 202 progeny without pigmented leg hairs ('usual' type), 3.5% had a random spot whereas for those with pigmented leg hairs 18.2% were affected. The main occurrence was among those sheep with pronounced leg hair pigmentation. The basis of this association may be a combination of greater numbers of pigment cells migrating and random skin regions that can support pigment cell colonisation of wool or hair follicle bulbs.

Keywords: Random spot, white Merino sheep

INTRODUCTION

Random spot is defined here as one or more distinct rounded areas of pigmented fibres on the white coat of young sheep, that do not conform to other recognised patterns, and typically show positional asymmetry. Brooker and Dolling (1969) found that black random spots, except possibly in the case of somatic mutation, were not determined by factors at the presumed Agouti locus (Parsons *et al.* 1997, 1999) that allows occurrence of recessive black lambs. Fleet and Smith (1990) found that the majority of Merinos with random spots had white wool without isolated pigmented fibres and the main risk was that some spots may be missed during shearing. There was also no association found between occurrence of lambs with random spots from ewes with or without old-age spots mated to rams with random spot (Fleet *et al.* 1985).

While pigmentation types may change with age they generally are not affected by other environmental effects often important for production characters (Fleet 1997). The genetic basis of random spots is not simply determined (Brooker and Dolling 1969) and the heritability may be low (Fleet 1996; Fleet 1997). When sheep with random spots were mated the occurrence of affected progeny varied between 0% and 42%. Similar results were found when affected rams were mated to white ewes, while occurrence was lower on average with unaffected parents (Brooker and Dolling 1969; Fleet *et al.* 1985). Other types of visible pigmentation can have high heritabilities in Merinos (Fleet 1996, 1997) and could possibly be used to indirectly influence future occurrence of random spots. It is now understood that isolated pigmented fibres are related to visible hair pigmentation on the coat (Fleet *et al.* 1995, 1997) though relationships with random spot have not previously been presented. This report involved an experiment in which isolated pigmented wool fibres was studied in relation to pigmented leg hairs (Fleet 1996, 1997) and reports on the relationship with random spot.

MATERIALS AND METHODS

Merino flocks traditionally have a low incidence of sheep with pigmented hairs on the legs. However, it was unclear originally whether this or other types of visible pigmentation could influence wool quality. Four hundred Merino ewes, with or without pigmented hairs on the legs, were selected from three Merino flocks and randomly allocated to rams with (n=9) or without (n=6) pigmented leg hairs. The 411 progeny born at Turretfield Research Centre were assessed for visible (macroscopic) fibre pigmentation as new-born lambs, lamb shearing (4 months) and hogget shearing (16 months). Colour and location of random spots were also noted at lamb marking (2 to 8 weeks age).

Classification of progeny for pigmented leg hairs involved the highest degree evident on any of the legs at birth, lamb shearing (4 months) or hogget shearing (6 months). The range of scores for visible pigment types used in this paper ranged from (0) no pigmented evident (1) minor degree (2) moderate (3) patches or (4) large area (>50%) pigmented. Departure from independence between occurrence of random spot and presence or absence of leg hair pigmentation was assessed with the chi-square statistic.

RESULTS AND DISCUSSION

Of the 411 progeny inspected there were 45 identified with a random spot and of these 29 (64%) were black-grey in colour, 14 (31%) were brown-tan in colour, and 2 (4%) had spots of both colours. All of the rams produced at least one progeny with a random spot and incidence ranged between 3% and 24%. The rams without pigmented leg hairs produced 157 progeny of which 8.3% had a random spot while rams with pigmented leg hairs produced 254 progeny and 12.6% were affected but this difference between ram types was not significant (chi-square1 = 1.86 n.s.). Nearly half of the progeny (51%) had diffuse or symmetrical leg hair pigmentation and most (84%) of the sheep with a random spot were in this group. The overall incidence of progeny with a random spot among those sheep without pigmented leg hairs was 3.5% and those with pigmented leg hairs was 18.2% (chi-square1 = 22.8, P<0.001).

Table 1. Number of random spot progeny within grades for degree of pigmented leg hairs

Degree Random spot	None	Few leg hairs Pigmented	Many spots / leg hairs	Patches	Large area
Absent	195	35	39	30	67
Present	7	4	3	10	21

The results indicate that presence of pigmented leg hairs was associated with occurrence of random spots and the effect was most pronounced for those progeny with patches/large areas of pigmented leg hairs. Presence of leg hair colour is associated with increases in most other pigmentation types (Fleet *et al.* 1995). These relationships may reflect a greater migration/incidence of pigment cells over the coat (Fleet *et al.* 1993) and skin conditions that can support pigment cell colonisation and development of fibre pigmentation and, or, skin epidermis pigmentation or hoof pigmentation. It has been noted that fleece structure can differ between black spot and white areas on the same animal (Brooker 1968; Ryder and Adalsteinsson 1987) and this is also consistent with a mosaic inherited or somatic change in certain skin areas. Usually fibre pigmentation develops at a critical period in early foetal life (Fleet 1997; Fleet *et al.* 1998) and can be observed on new-born lambs but some other spots apparently develop or expand later in life. These later occurrences of fibre spots may reflect indirect or delayed migration of pigment cells and, or, localised changes in skin conditions that allow pigment cell colonisation (Fleet 1997).

It could be speculated that selecting against all types of pigmentation might help reduce occurrence of random spots. Table 2 shows for progeny without pigmented leg hairs, the mean score, range of scores and proportion of sheep without each type of pigmentation among those progeny with and without a random spot. These results, although not definitive, are consistent with the speculation. However, such residual skin and hoof pigmentation (remaining after attention to indicators of isolated pigmented wool fibres) may be frequent in Merino flocks (Fleet *et al.* 1997) and considerable overlap exists (Table 2). Brooker (1968) scored various types of pigment on the progeny of random spot rams and compared them with matings of unaffected rams. It was found that presence or absence of any of the pigment types scored could not be used to distinguish progeny of random spot rams. It seems an inefficient practice to select against common types of pigmentation to achieve some degree of reduction of random spots since this fault can be observed during close inspections involved as part of a complete dark fibre control system (eg. Fleet 1999).

Table 2. Mean pigment scores and proportion of sheep without pigment (score 0)

Random spot (No.)		Affected (n=5)		Unaffected (n=150 to152)	
Pigment type		Mean score	% No pigment	Mean score	% No pigment
Nose-lips skin	- lamb shearing	1.8	20.0	1.31	35.5
	- hogget shearing	2.2	0.0	1.73	20.7
Hooves	- lamb shearing	1.4	40.0	0.32	81.6
	- hogget shearing	1.6	40.0	0.26	81.3

Control of pigmentation on the coat of white Merinos likely involves a complex of genes and will remain incomplete and less than ideal until a single gene that enables satisfactory effect in its own right is identified and widely used. The absence of pigmentation is usually the result of white spotting genes which prevent the development of fibre pigmentation through several mechanisms (Silvers 1979), for example:

- Precursor pigment cells (melanoblasts) may fail to originate
- Melanoblasts may fail to migrate or reach the skin
- Melanoblasts may be unable to differentiate and colonise the skin
- Migration of melanocytes may be delayed until after fibre follicles develop
- Melanoblasts may be unable to pigment follicles after arrival in the skin
- Premature or sudden death of melanocytes may leave some areas white.

Crossing of sheep with different combinations of genes inhibiting pigmentation will likely result increased pigmentation among the progeny (Singh and Singh 1971; Singh and Chaudary 1972). The opportunity exists to identify the white spotting genes controlling pigmentation in sheep, which likely have homologies with those in mice (Silvers 1979 Fleet *et al.* 1999), and possibly characterise for practical detection those genes most effective at preventing pigmentation. Another possibility could be the development or use of a gene that prevents pigment cell function rather than influencing location of these cells over the coat (Rowett and Fleet 1993).

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