ISSN 0370-2731/2003 Proceedings of the New Zealand Society of Animal Production 63: 160-163

Assessment of fleece cover in crosses between Coopworth, Dorper, Damara, New Zealand Wiltshire, Poll Dorset and Suffolk sheep.

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ABSTRACT

Fleece cover was assessed over 10 body regions for nine pure and crossbred combinations of progeny from long-wool, short-wool and hair breeds of sheep. Assessments were made between docking and hogget shearing. Visually assessed fleece-cover scores varied by less than 0.35 units within day (P = 0.757) and 0.21 units between days (P = 0.120). Differences of 0.2 units between assessors (P<0.05) were tolerable in a scoring system utilising whole measurement units. The average fleece cover of Wiltshire and Dorper x Wiltshire lambs was 1.14 and 0.92 units less than Coopworth lambs at weaning (P<0.01) but no different at hogget shearing (P = 0.17). The temporary reduction in fleece cover at weaning was attributed to shedding of fibres from the fleece. All breed combinations studied produced between 29 and 67% less fleece than Coopworth hoggets (P<0.001). However, without the ability to synchronously shed their fleece, first generation crossbred progeny required shearing as hoggets.

Keywords: Dorper; Damara; Wiltshire; crossbred; fleece cover; visual score.

INTRODUCTION

New Zealand sheep producer's quest to improve economic and productive performance has led to the introduction of numerous exotic breeds. Recently, two hair breeds were imported. Dorper were developed in South Africa, by crossing Blackhead Persian ewes with Dorset Horn rams, to produce a high proportion of lambs with good carcass characteristics. Dorper are characterised by a short covering of black or white hair on the head, a short, light covering of wool and hair on the body and a distinct hair underline. Damara are fat-tailed, meat sheep indigenous to South Africa. They have a short, smooth, coloured hair coat like that of cattle and do not require shearing. A third breed, New Zealand Wiltshire (derived from crosses between Wiltshire Horn and Poll Dorset breeds), has fleece attributes similar to those of Dorper and is established throughout New Zealand. All three breeds shed their fleece annually and possess the pattern of fleece cover and fleece shedding attributes suitable for developing specialised meat-producing sheep, animals that express fast growth rates, have good carcass characteristics and do not require shearing.

This paper evaluates a scoring system for assessing fleece cover and describes the changes in fleece cover of pure and crossbred combinations of progeny from Dorper, Damara, Wiltshire, Coopworth, Poll Dorset and Suffolk breeds, from docking to hogget shearing.

MATERIALS AND METHODS

Scoring system

Archer *et al.* (1982) compiled a subjective scoring system to describe the fleece cover on six body regions of pure and crossbred Merino sheep. Diagrammatic standards against which to score fleece cover were presented for leg (front and back), head (nose and jowl), anal and breech body regions. The scoring system was extended in this study to include belly, brisket, neck and flank regions. These additional body regions were defined as those areas from which wool would be removed during a conventional shearing operation. A critical difference in methodology was that the five-point scale used in this study (1 = complete fleece cover, 5 = no fleece) was the reverse order of that used by Archer *et al*. (1982).

The consistency of fleece scores between assessors, within a day and between days, was examined using four replicates of 14 hoggets, presenting a range of fleece covers. Each replicate was scored twice a day on day 1, day 2 and day 7. Each animal was scored simultaneously by four people. The order of scoring animals within replicates and the order of scoring replicates was randomised on each occasion. Average fleece cover score was calculated as an unweighted mean value of all body regions. Variation in fleece scores, within and between days and assessors, was calculated using analysis of variance for a balanced, incomplete-block design.

FLEECE COVER

Over a three-year period, the fleece cover of 368 lambs was assessed at docking and hogget shearing, at 50 weeks of age. Lambs were scored on five intermediate occasions in the initial two years and on three intermediate occasions in the final year. No wool was removed from the animals until after fleece cover assessment at hogget shearing. Breeds assessed for each year of birth were:

1999 Coopworth, Wiltshire, Wiltshire x Coopworth

2000 Coopworth, Wiltshire, Wiltshire x Coopworth, Dorper x Coopworth, Dorper x Wiltshire, Damara x Coopworth

2001 Coopworth, Wiltshire, Dorper x Coopworth, (Dorper x Coopworth) x Coopworth, Dorper x Wiltshire, Dorper x Suffolk, Damara x Poll Dorset

The same Coopworth, Wiltshire and Damara sire and two Dorper sires were used to produce all lambs. Ewes were selected on availability and were not necessarily representative of the breed. Data were analysed using the REML procedure of Genstat 6, with year of birth, sex and breed as fixed components.

Staple length and fleece weight

Staple length was measured, by ruler, on one staple growing on the midside of each animal. The weight of fleece grown since birth was recorded at hogget shearing.

Fibre grown on the belly, nose and jowl was excluded from the weight, as was fibre shed as lambs. Shedding was observed to differ between breeds but the extent of shedding was not quantified. Staple length and greasy fleece weight data were included as part of the fleece cover analysis.

RESULTS

Scoring system

Fleece cover scores averaged over the 10 body regions varied by less than 0.35 units within days (P>0.1) and 0.21 units between days (P>0.1). The average fleece score recorded by assessor 4 was lower than those of assessors 1 and 2 (P<0.05, Table 1). Assessor 3 recorded lower average scores than all other assessors (P<0.05), though average values differed by less than 0.2 units between assessors. The order in which scores for individual body regions were ranked varied inconsistently between assessors (P<0.05). Notably, assessor 3 scored the anus lower, and assessor 1 scored the flank higher than other assessors did. Brisket scores for each assessor differed significantly (P<0.05), (Table 1).

TABLE 1: Average fleece cover scores from six replicates of 56 hoggets, for 10 individual body regions and four assessors.

	assessor				
body region	**1**	**2**	**3**	**4**	**lsd $_{0.05}$**
front legs	3.39	3.44	3.27	3.25	0.07
back legs	2.61	2.99	2.45	2.48	0.06
nose	3.65	3.89	3.61	3.79	0.18
jowl	2.98	3.46	3.24	3.42	0.07
anus	2.87	2.77	1.93	2.86	0.19
breech	2.99	2.99	2.78	2.89	0.17
belly	1.97	1.51	1.15	1.38	0.23
brisket	2.68	1.98	3.24	2.26	0.18
neck	1.25	1.26	1.06	1.17	0.15
flank	1.34	1.10	1.08	1.15	0.09
average	2.57	2.54	2.38	2.46	0.07

Fleece cover

It should be noted that a decrease in fleece-cover score specifies an increase in fleece cover. Additionally, a negative fleece-cover score specifies greater fleece cover than that recorded for Coopworth animals.

Breed differences in overall fleece-cover scores were first detected at 15 weeks of age when lambs were weaned (Table 2). The average fleece cover of Wiltshire and Dorper x Wiltshire lambs was 1.14 and 0.92 units less, respectively, than Coopworth lambs (1.56), (P<0.001). At 23 weeks of age the fleece cover of Wiltshire hoggets was 0.4 units closer to that of Coopworth, while the fleece cover of Dorper x Wiltshire hoggets was 0.09 units lower than fleece cover at weaning. At 50 weeks of age, the average fleece cover of all breeds was similar to that of Coopworth hoggets (1.68 units, P>0.1).

At weaning, all body regions except the head and anus of Wiltshire, and head (nose and jowl), front legs and anus of Dorper x Wiltshire lambs, had less fleece cover (positive deviation) than Coopworth lambs (P<0.05, Table 3). All other breeds, except (Dorper x Coopworth) x Coopworth recorded increased or decreased fleece-cover scores, relative to the Coopworth, on two or more body regions (P<0.05). Notably, Wiltshire x Coopworth, Damara x Coopworth and Damara x Poll Dorset lambs had less fleece cover (positive deviation) on the breech and brisket than Coopworth lambs. Dorper x Coopworth lambs had more fleece cover (negative deviation) on the nose and jowl. Dorper x Suffolk lambs had less fleece cover on the breech and brisket and more fleece cover on the nose and jowl.

Between weaning (Table 3) and hogget shearing (Table 4) the area of brisket covered with fleece remained unchanged for Dorper x Suffolk, Dorper x Wiltshire, Wiltshire, Damara x Coopworth and Damara x Poll Dorset animals. The area of fleece cover on the breech, belly, neck and flank of Dorper x Wiltshire and front and back legs, breech, belly and neck of Wiltshire increased similar to that of Coopworth animals. By hogget shearing, the heads (nose and jowl) of Damara x Coopworth and Damara x Poll Dorset hoggets had more fleece cover than Coopworth hoggets.

Fleece cover was less on the breech and brisket of both Damara crosses at weaning but, by shearing, fleece cover on the breech was not significantly different to Coopworth hoggets (P=0.09).

Staple length and fleece weight

Deviation in staple length and greasy fleece weight, from the Coopworth control, are presented in Table 4. Compared to staples of Coopworth wool (118 mm), staple length was shorter for Wiltshire x Coopworth and Damara

TABLE 2: Deviation, from Coopworth control, in average fleece-cover score of eight sheep breeds, scored between docking and hogget shearing.

		age (weeks)						
Breed	**no.**	**4 [1]**	**10**	**15 [2]**	**19**	**23**	**33**	**50 [3]**
Coopworth	72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Dorper x Coopworth) x Coopworth	40	0.00	0.08	0.00	-	0.03	-	0.01
Wiltshire x Coopworth	71	0.00	0.02	0.30	0.31	0.31	0.18	0.12
Dorper x Coopworth	20	0.00	-0.17	-0.17	-0.37	-0.22	-0.22	-0.35
Dorper x Suffolk	52	0.00	-0.08	0.22	-	0.31	-	0.22
Dorper x Wiltshire	37	0.00	0.16	0.92	-	1.01	-	0.34
Wiltshire	49	0.00	0.37	1.14	1.20	0.74	0.50	0.04
Damara x Coopworth	14	0.00	0.07	0.18	-0.04	-0.05	-0.12	-0.01
Damara x Poll Dorset	13	0.00	0.23	0.36	-	0.33	-	0.06
lsd $_{0.05}$		0.28	0.38	0.47	0.36	0.35	0.30	0.37

[1] docking
[2] weaning
[3] shearing

TABLE 3: Deviation in average fleece-cover score of eight sheep breeds, relative to the Coopworth control, scored at weaning on 10 body regions.

body region	(Dorper x Coopworth) Coopworth	Wiltshire x Coopworth	Dorper x Coopworth	Dorper x Suffolk	Dorper x Wiltshire	Wiltshire	Damara Coopworth	Damara x Poll Dorset	$lsd_{0.05}$
nose	-0.38	0.49	-1.06	-0.78	-0.02	0.19	-0.74	0.53	0.62
jowl	-0.07	0.85	-1.03	-0.58	0.16	0.48	-0.22	-0.35	0.58
front legs	0.15	0.49	-0.07	0.28	0.61	0.96	0.03	1.07	0.69
back legs	0.20	0.78	0.17	0.84	1.05	1.16	0.67	1.14	0.78
anus	0.04	0.23	0.16	0.20	0.16	0.44	-0.09	0.72	0.77
breech	0.58	0.74	0.36	1.04	1.23	1.13	1.12	0.99	0.74
belly	0.23	-0.06	0.08	0.28	1.47	2.04	-0.07	0.20	0.73
brisket	-0.01	0.99	0.16	1.13	2.04	2.05	1.20	1.06	0.76
neck	-0.09	0.14	0.03	0.18	1.91	2.72	0.17	-0.09	0.76
flank	-0.30	0.20	-0.04	0.01	1.03	1.24	0.27	-0.22	0.55
average	0.00	0.30	-0.17	0.22	0.92	1.14	0.18	0.36	0.47

TABLE 4: Deviation in hogget fleece-cover score (score units), on 10 body regions, staple length (mm) and fleece weight (kg), of eight sheep breeds, relative to Coopworth control.

body region	(Dorper x Coopworth) Coopworth	Wiltshire x Coopworth	Dorper x Coopworth	Dorper x Suffolk	Dorper x Wiltshire	Wiltshire	Damara Coopworth	Damara x Poll Dorset	$lsd_{0.05}$
nose	0.47	0.26	-0.93	-0.60	-0.19	-0.29	-1.44	-1.17	0.57
jowl	-0.24	0.49	-1.28	-0.43	-0.26	0.29	-0.90	-1.26	0.59
front legs	0.24	-0.01	-0.49	0.39	0.31	0.25	-0.43	1.40	1.76
back legs	0.16	0.75	-0.76	0.79	0.91	0.50	0.02	1.19	0.64
anus	-0.09	0.35	0.26	0.57	-0.20	-0.68	0.76	0.09	0.81
breech	-0.24	0.67	-0.48	0.41	0.41	-0.30	0.47	-0.58	0.92
belly	0.08	-0.04	0.01	0.16	0.46	0.34	0.08	0.08	0.59
brisket	0.04	0.63	0.55	1.20	1.89	1.20	1.46	1.12	0.73
neck	0.06	-0.07	0.01	0.10	0.34	0.24	-0.04	0.06	0.47
flank	0.05	0.23	0.06	0.05	0.11	0.46	0.34	0.05	0.41
score	0.01	0.12	-0.35	0.22	0.34	0.04	-0.01	0.06	0.37
staple length	-14	-26	-46	-59	-61	-60	-28	-46	19
fleece weight	-0.32	-0.65	-0.95	-1.64	-1.88	-1.87	-1.50	-1.74	0.45

x Coopworth, by 22 and 24%, respectively. Staple lengths of Dorper x Coopworth and Damara x Poll Dorset were 39% shorter. Those of Dorper x Suffolk, Wiltshire and Dorper x Wiltshire were 50, 51 and 52% shorter, respectively ($P<0.001$, for each 10% change in length). Greasy fleece weights of Wiltshire x Coopworth and Dorper x Coopworth fleeces were 29% lower than Coopworth fleeces (2.80 kg). Weights of Damara x Coopworth, Damara x Poll Dorset and Dorper x Suffolk fleeces were 58% lower and Dorper x Wiltshire and Wiltshire fleeces 67% lower than Coopworth fleeces ($P<0.001$, for each group).

There was a strong positive correlation between staple length and hogget fleece weight ($r = 0.89$, $P<0.001$). Average fleece cover score was negatively correlated with staple length ($r = -0.29$, $P = 0.51$) and fleece weight ($r = -0.38$, $P = 0.51$). Table 4 shows that, relative to Coopworth hoggets, Dorper x Wiltshire hoggets recorded the highest average fleece-cover score (least cover), shortest staple length and lowest fleece weight. Wiltshire hoggets had a similar average fleece-cover score as Coopworth hoggets, but staple length and fleece weight were as short and light as for Dorper x Wiltshire hoggets. The average fleece-cover score of Dorper x Coopworth hoggets was less (more fleece cover) than Coopworth hoggets yet staple length and fleece weight were significantly less ($P<0.01$).

DISCUSSION

The modified system of scoring fleece cover provided a reasonable method of assessing fleece cover. Statistically significant differences between assessors, of 0.2 units for fleece scores averaged over all body regions, were tolerable in a scoring system utilising whole measurement units. The largest differences between assessors occurred on the brisket (1.3 units), belly (0.9 units) and anal (0.9 units) body regions. Differences in identification of subjective boundaries between body regions could account for the large variations in fleece-cover scores between assessors. The brisket was particularly difficult to define, encompassing an area from the lower end of the neck to the upper end of the belly and extending laterally to the axilla. The belly region was easier to define, but introduced potential confusion between area of fleece cover and length of fleece cover when fleece had shed and regrown. Fibre shedding started when lambs were between 9 and 15 weeks of age. Inconsistencies between assessors when scoring the anal region concur with observations of Archer *et al.* (1982). The area around the anus that is or is not covered with fibre was often difficult to discern because of the graduation in fibre lengths at the boundary. Variations in fleece-cover score of individual body regions tended to balance when the scores of individual assessors were averaged over all body regions. However, to compare relative fleece cover between animals of the same or differing breeds, it is

advisable that the same assessor is used for all animals.

The temporary reduction in average fleece cover of the Wiltshire and Dorper x Wiltshire breeds, at weaning and on subsequent occasions with the exception of hogget shearing, was attributed to the synchronised shedding of fibres from the fleece. Reduced fleece cover occurred predominantly on breech, belly, brisket, neck and flank regions for these breeds. Shedding and regrowth of fleece on these areas has also been described in Wiltshire x Romney (Thatcher & Pascoe, 1973) and Wiltshire x Merino (Rathie *et al*., 1994) lambs. Dorper x Suffolk animals did not express the fluctuations in fleece cover seen in Wiltshire and Dorper x Wiltshire, which suggested shedding characteristics were contributed by the Wiltshire rather than the Dorper parent. The suggestion was further supported where Wiltshire x Coopworth but not Dorper x Coopworth animals had less fleece cover on the brisket and breech at weaning but not at hogget shearing. Damara parentage appeared to induce fibre shedding from the breech when crossed with Coopworth or Poll Dorset breeds.

A closer look at fleece cover on individual body regions highlights the need for cautious interpretation of average fleece-cover scores. Only Wiltshire and Dorper x Wiltshire recorded average fleece-cover scores different to Coopworth and then only at weaning. However, all first-cross progeny recorded greater or lesser fleece cover on at least one body region, at both weaning and shearing. Dorper x Suffolk animals had more fleece cover on the nose and jowl and less cover on the breech and brisket than Coopworth animals. These positive and negative changes in fleece-cover scores for Dorper x Suffolk appeared to offset each other and produced no overall difference in the average fleece-cover score relative to Coopworth animals. Average fleece-cover scores calculated using unweighted means of all body regions were not the most appropriate descriptors of fleece cover. Fleece-cover scores for individual body regions relevant to a specific sphere of study, would be more appropriate.

All breeds studied, except the (Dorper x Coopworth) x Coopworth produced less fleece and shorter staples than Coopworth hoggets. The reduction in staple length, fleece cover and fleece weight was not sufficient to remove the need to shear hoggets. The same requirement to shear first-generation crosses of Dorper with Merino and Damara with Merino were reported in Australia (Hills & Young, 1999; Young & Quin, 2000). It is thought that the need to shear will not be eliminated until the third backcross with Merino (Hills & Young, 1999; Young & Quin, 2000).

The score system was able to detect permanent differences in fleece cover between breeds, and temporary differences resulting from fibre shedding. However, the reduction in fleece-cover was not sufficient to remove the requirement to shear the first generation of crossbred hoggets. The production of a specialised meat-producing sheep that does not require shearing will require repeated backcrossing to breeds with a tendency to shed their fleece.

ACKNOWLEDGEMENTS

The author wishes to thank Denis O'Connell, Stuart Young and Colin Clemens for assistance with this project and Dave Saville and David Baird for statistical analysis.

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