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EFFICACY OF SHEEP COATS FOR PART OF THE YEAR IN WESTERN AUSTRALIAN MERINO FLOCKS

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SUMMARY
A total of 6 flocks were used to determine the potential of sheep coats for use during the dry and dusty period prior to shearing (4 flocks) or for 12 months (2 flocks) of the year to improve wool quality. Coats significantly ($P<0.05$) reduced wool dust content, suint content and vegetable matter contamination leading to improved wool yields. There were no significant differences ($P<0.05$) between wool outcomes for sheep coated for the dry and dusty period of the year prior to shearing or 12 months of the year. Fibre diameter, staple length, staple strength, clean fleece weight, wool brightness, wool yellowness, wax content and value of fleeces were not significantly ($P>0.05$) changed by the use of coats. Use of coats improved ($P<0.05$) yield of wool tops from greasy wool, but did not significantly ($P>0.05$) alter the other parameters of wool top measured. The margin gained from improved wool quality and shorter periods of coat usage is likely to make sheep coats viable for a wider range of wool types than has been previously considered for coating.

Keywords: sheep coats, wool yield, dust content, vegetable matter content, top, hauteur

INTRODUCTION
The Western Australian selling centre in Fremantle had an average wool yield of 62.0% across all wool types compared to the Australian average of 66.3% in 2001/2 (Wooltrak 2002). Wool yields in Western Australian wool zones range from 48.1 to 66.1%, with no other State wool zone recording wool yields this low. Poor yields in Western Australia, and in the traditional wheat/sheep areas in particular, have tended to restrict the opportunities for sheep breeders to use fine-wool blood lines of sheep to reduce fibre diameter. In poor yield environments, sheep coats have the potential to protect the fleece from dust contamination, leading to improvements in wool quality and price.

Sheep coats have a long history since the 1930's, and have been extensively evaluated in Australia to improve wool quality (Ford and Cottle 1993). A number of coat designs and manufacturers were used in these studies and results are conflicting in terms of wool growth and quality outcomes. Hatcher *et al*. (2003) found an improvement in wool style through improved colour, reduced tip weathering and increased yield by using sheep coats on fine wool sheep in the western districts of New South Wales. They found that it was economically viable to coat fine wool sheep but not medium wool sheep. This paper determines the efficacy of using sheep coats in a range of environments in Western Australia and the potential of restricting the use of sheep coats to dry and dusty periods of the year to improve wool quality.

MATERIAL AND METHODS
The late summer and autumn shorn sheep used in this study were supplied by commercial wool growers in Western Australia. The nearest town for 3 of the flocks was Gairdner (34°12' S; 118°56' E), and 1 each near Kununoppin (31°06' S; 117°55' E), Arthur River (33°20' S; 117°02' E) and Wannamal (31°09' S; 116°03' E). Each flock was randomly split into a control and coated treatment group, with a minimum of 70 sheep in each treatment group. In 2 of the flocks at Gairdner, coats were maintained on coated groups for 12 months, while in the remaining flocks, coats were used from September until the sheep were shorn in the following calendar year, in late February/March for the Gardiner, Kununoppin and Wannamal flocks, and April for the Arthur River flock. Sheep coated for 12 months had their coat changed during the year to accommodate increased body size due to wool growth and liveweight changes. Coats fitted for part of the year were sufficiently adjustable in design to not require a size change before coat removal at shearing.

Coated and control sheep were managed as a single flock at each property during the year and animal husbandry practices were in accordance with property requirements to maintain healthy and productive animals. Chemical usage for fly control was recorded for the coated and control sheep in each flock, and the incidence of mycotic dermatitis was recorded prior to shearing. At shearing, control and coated sheep were shorn separately. Greasy fleece weight was recorded and fleeces handled according to wool shed codes of practice, with control and coated wools being maintained as separate fleece lines. Sheep were weighed after shearing. Fleece wool from the control and coated sheep for each flock were consigned to auction as separate lines for sale on the same day. Bales from each treatment group for each flock were core sampled for wool testing at the sale centre. Core samples were tested by the Australian Wool Testing Authority and the wool measurements recorded from the sale catalogue. Wool wax, suint and dust indexes were determined on the keeper core samples according to the method of Ladyman *et al*. (2003). Chemical residues in wool core samples were determined using IWTO-TM-59-02. In 1 of the coated groups, coated fleeces were divided into coated and non-coated fleece segments at shearing, and consigned as separate fleece sale lots. These 2 lines from 'coated' wool were re-constructed, on the basis of the ratio of coated fleece and non-coated fleece weights, to a calculated 'coated' fleece wool line for the purpose of data analysis.

Control and coated fleeces from 4 control and 4 coated flocks were processed to tops by CSIRO Textile and Fibre Technology, Geelong. The 8 lines of tops produced were sourced from 1 flock from Gardiner, consisting of control and coated for 12 months, and the other 3 flocks were controls and coats used for the dry and dusty period of the year prior to shearing from Gardiner, Arthur River and Wannamal. Tops were measured for Hauteur, Romaine, coefficient of variation in Hauteur (CVH), percent of fibre less than 35 mm, number of vegetable particles per 10 g of tops, yield of tops from greasy wool and fine ends in the top.

Data were analysed using analysis of variance in Minitab®, where $P<0.05$ was considered to be significantly different.

RESULTS

There were no statistical differences between using coats for 6 or 12 months in the raw wool and top parameters measured, therefore, results are reported as control and coated treatments only. The liveweights of control and coated sheep were not significantly different, weighing 43.9 and 43.3 kg post shearing, respectively.

Fleece variables for control and coated sheep are shown in Table 1 and 2. Sheep coats significantly increased yield and reduced vegetable matter contamination (Table 1), and suint index and dust index (Table 2). The use of sheep coats wool did not significantly alter clean fleece weight, fibre diameter, staple length (Table 1), staple strength, wax index, wool brightness, and wool yellowness (Table 2). The greasy wool price per kg was not significantly improved by the use of sheep coats. A loss was made on the coated wool lines at Wannamal that were split into coated and non-coated fleece wool, to be sold as separate lines of 'coated' wool. There was a premium for the coated fleece wool lines, but a significant discount for the non-coated parts of the fleece, resulting in a poorer return for coated fleece wool overall from the Wannamal flock. For the other flocks, the coated wools were sold at auction for a higher value than control wools. Over the 6 flocks, fleece wool averaged 568 and 715c/kg for greasy wool ($P=0.090$), or 980 and 1,037c/kg on a clean wool basis ($P=0.605$), from control and coated sheep, respectively.

Table 1. Effect of sheep coats on fleece yield, clean fleece weight (CFW), fibre diameter (FD), vegetable matter content (VMB), staple length (SL) and staple strength (SS).

Treatment	No. flocks	Treatment	Yield (%)	CFW (kg)	FD (μm)	VMB (%)	SL (mm)	SS (N/Ktex)
Control	6	Control	57.6^A	2.66	19.17	1.95^A	80.3	29.5
Coated	6	Coated	69.0^B	2.87	19.27	0.70^B	83.5	29.0

$^{A, B}$ Means in the same column with different superscripts are significantly different ($P<0.05$)

Table 2. Effect of sheep coats on wax index, suint index, dust index, brightness (Y) and yellowness (Y-Z).

Treatment	No. flocks	Wax index (%)	Suint index (%)	Dust index (%)	Y	Y-Z
Control	6	21.8	13.7^A	32.4^A	72.6	8.1
Coated	6	23.3	9.2^B	11.3^B	75.1	8.2

$^{A, B}$ Means in the same column with different superscripts are significantly different ($P<0.05$)

Mycotic dermatitis was observed in all except the Kununoppin flock. Sheep fitted with coats for 12 months of the year recorded no incidence of mycotic dermatitis whereas the control groups for these flocks had a 16.7% incidence of mycotic dermatitis (P=0.23). In the case of sheep coated for 6 months of the year, mycotic dermatitis occurred before the coats were placed on the sheep and once the coats were fitted the hardened exudates lifted from the skin. Hardened exudates lifting from the skins did not always occur in the control sheep and incidence of exudate lifting was not recorded at shearing. Residues of total organophosphates on 3 farms averaged 0.4 and 0.3 mg/kg of wool for control and coated wool, respectively (P=0.72), synthetic pyrethroids on 1 farm averaged 11 and 24 mg/kg on wool for control and coated wool, respectively, and total diflubenzuron plus triflumuron on 3 farms average 52.2 and 3.0 mg/kg on wool for control and coated wool, respectively (P=0.12).

The percentage of top produced from greasy fleece wool was significantly improved by the use of sheep coats (Table 3). There was a non significant increase in Hauteur of 7.8 mm (P=0.26). Sheep coats did not significantly reduce the percentage of fibres in the top less than 35 mm, with the percentage of short fibres being 7.45 and 2.65% for control and coated wools, respectively (P=0.26). Scoured wools from control fleeces contained 6.93% vegetable matter compared with 0.93% vegetable matter in scoured wool from coated fleeces (P=0.23). In the finished tops, coated wool tops had reductions in number of vegetable matter particles less than 3 mm (P=0.16), number of vegetable matter particles between 3 and 10 mm (26 and 7 particles/100 g top for control and coated wool tops respectively, P=0.09) and number of vegetable matter particles greater than 10 mm in the top compared to tops from the control lines of wool (P=0.11). Fibre diameter of top fibre ends averaged 1.6 μm finer than the top average for control wool tops, and 2.0 μm finer than the top average for coated wool tops (P=0.25). Coated wool produced significantly more top plus noil from greasy wool than the control wool lines (57.5 and 72.5% for control and coated wools, respectively, P<0.001).

Table 3. Effect of sheep coats on means top Hauteur (H), Hauteur coefficient of variation (CVH), Romaine (R), number of vegetable matter particles<3mm (VM<3), number of vegetable matter particles>10 mm (VM>10)and percentage of tops produced from greasy wool (Tops).

Treatment	H (mm)	R (%)	CVH (%)	VM<3	VM>10	Top (%)
Control	71.7	13.5	34.5	135.5	8.0	50^{A}
Coated	79.5	7.1	32.6	33.5	0.5	66^{B}

^{A,B} Means in the same column with different superscripts are significantly different (P<0.05)

DISCUSSION

Sheep coats were successful in reducing the dust and vegetable matter contamination of Western Australian wools, which is consistent with previous reports for sheep coats (Ford and Cottle 1993). Similar reductions in wool contamination were achieved using coats from late September to shearing in February to April of the following year instead of the traditional approach of covering sheep for 12 months. The wool value margin for using sheep coats was 57c/kg of clean wool more than for control sheep at auction, less than the 98c/kg of clean fine wool from coated fleeces achieved in western New South Wales (Hatcher *et al.* 2003). The success of using sheep coats for a shorter period of the year increases coat life expectancy and reduces costs for coat checking and changes to allow for increases in sheep size during the year. The potential to use sheep coats strategically for a part of the year increases the opportunity for profitable use of sheep coats across a wider range of wool types.

Davies *et al*. (1994) found an increase in clean fleece weight of 15%, or 0.6 kg, compared with a non-significant increase of 0.22 kg of clean wool in this experiment. Ford and Cottle (1993) reported an increase in clean fleece as a benefit of using sheep coats across a number of experiments, but Hatcher *et al*. (2003) found no improvement from using sheep coats in western New South Wales. Increased clean fleece weight can be attributed, in part, to increased staple length through reduced tip weathering. There was a non-significant improvement in staple length from using sheep coats of 3.2 mm in this experiment, and trend similar to the 4 mm reported by Hatcher *et al.* (2003) and the 5 mm reported by Davies *et al.* (1994).

Contrary to the report of Lipson *et al*. (1970), there was not a significant effect on wool wax content, but there was a significant decrease in wool suint with the use of sheep coats. There is no ready explanation for a reduction in suint content unless coating provides increased protection from summer temperatures leading to reductions in sweating. Lipson *et al*. (1970) reported that skin temperatures were 10°C lower in coated sheep on a hot day than for non-coated sheep.

Sheep coats made only minor changes to the performance of tops produced from coated wools, and most of the changes were not significantly different for most of the parameters measured, except for the efficiency of extracting tops from greasy wool. Changes to tops measured in this experiment were of a similar order of magnitude to those reported for Chinese coated wools (Crowe *et al*. 1996) and in previous studies of coated wools in Australian flocks (Ford and Cottle 1993). Changes in top length are likely to be a function of both improved staple length and reduced tip weathering with the use of sheep coats. Weathering of the tip is a function of duration of exposure to sunlight (Steenkamp *et al*. 1970) and weathered tips are lost to noil during processing (Walls 1963).

Our results are consistent with previous research by Abbott (1979), who reported a reduction in the incidence of mycotic dermatitis, although he pointed out that little systematic work has been done on this aspect of the use of sheep coats. Outbreaks of mycotic dermatitis occur when sheep are wet for extended periods of time (Roberts and Graham 1966), and consistent reports of reduced mycotic dermatitis in coated sheep may be a result of reduced wool wetting. Although rates of breakdown of insecticide were not specifically studied, coated sheep tended to have higher levels of chemical residues than the control sheep. This difference may be a function of light protection afforded chemicals in coated sheep as the rate of breakdown of insecticides in wool is affected by the degree of exposure to sunlight (Rammell and Bentley 1989).

In conclusion, sheep coats can be used to improve clean wool value at auction, and economic viability of sheep coats would be improved by the strategic use of sheep coats for part of the year. Restricting use of coats to times to the year with problems of vegetable matter and dust contamination increases the potential coat life, and is likely to reduce some of the handling costs associated with using sheep coats. Coats performed their function of reducing dust and vegetable matter contamination of the fleece. There was no significant effect on wool wax content, but suint was decreased in fleeces. Coated wool produced significantly more top plus noil from greasy wool than the non-coated control wool. There were changes in the incidence of mycotic dermatitis and rate of chemical breakdown in coated fleeces that warrant further investigation in experiments specifically designed to address these issues.

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http://www.wool.com.au/AWI/rwpattach.nsf/viewasattachmentPersonal/CE3E2B9B94DE7962CA256D04001D9F62/$file/FR_SheepCoats_20030210.pdf

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