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Four methods of harvesting cashmere from breeding does

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ABSTRACT

The effectiveness of hand combing, machine combing and body stocking covers relative to shearing were compared as methods of harvesting cashmere. Cashmere does were shorn on 4 August and combed on 4 August, 29 August and 3 October. Goats were covered and shorn on one side on 4 August and on the other on 3 October. Only 9 of the 40 goats retained their covers until 3 October. Machine combing was the least effective method of harvesting cashmere and produced a half fleece of 18±2 grams down while shearing was the most effective and produced a half fleece of 40±4 grams down. Hand combing and body stocking covers were intermediate and both produced a whole fleece of 4655 grams and a half fleece of 27±4 grams respectively. Cashmere wastage in dehaired guard hair was greater in combed fleeces than shorn fleeces. Despite the higher yield of combed fibre there was no reduction in the speed of dehairing. Harvest method had no effect on goat liveweight at 3 October.

Keywords Goats, cashmere, combing, shearing, covers, down weight, yield, fibre diameter, dehairing.

INTRODUCTION

On average, cashmere begins to grow at the summer solstice and is shed progressively from August onwards (McDonald, 1985; Graham, 1988; Mitchell et al., 1989). To optimise cashmere production in New Zealand, goats are shorn in early August. However newly shorn cashmere goats have a thermoneutral temperature of 23°C (Holmes and Clarke, 1989; Muller et al., 1991) and as a result many goats suffer from cold stress following shearing in the early spring. The retention of the coat of guard hair, which is considered a waste fibre in processing, as occurs when cashmere is harvested by combing reduces the thermoneutral temperature of goats to 18°C thereby giving them some resistance to cold (Muller et al., 1991). Combing will be more effective if shedding can be synchronised. Kidding is naturally synchronised in cashmere goats and pregnancy and lactation affect cashmere growth (Graham, 1988). It is possible that shedding is more synchronised in pregnant rather than dry does.

Shed cashmere can be trapped within a cover worn by goats and harvested at a later date when climatic conditions are more favourable. Two methods of combing of goats and covers were evaluated in dry and pregnant does in this experiment.

Dehairing of goat fleeces is a major processing cost in cashmere textile manufacture. The fibre diameter of guard hair and the number of guard hairs to be removed are both factors which could reduce the number of passes and hence cost of dehairing goat fleeces. During dehairing some valuable cashmere fibres can be removed along with the guard hair. Processors believe New Zealand fleeces have relatively high rates of cashmere loss during processing largely due to the presence of second cuts during shearing (Blackburn, 1987).

METHOD

Two hundred mixed age and two tooth does were statistically blocked on down length and pregnancy as assessed by ultra sound and randomly allocated to one of five treatment groups. The experiment was conducted in the spring of 1989 at the Wanganui Hill Research Station. Group A, (control) were totally shorn (whole fleece) on 4 August; Group B were shorn on one side (half fleece) on 4 August, while the other side was machine combed on 4 August, 29 August and 3 October; Group C were shorn on one side on 4 August (half fleece), covered with body stockings and the other side shorn on 3 October; Group D were totally machine
combed on the same dates as Group B; Group E were totally combed by hand on the same dates as Group B and D.

An automated machine comb (Wingate-Hill and Blinman, 1981) had rotating combs which passed through the fleece capturing the cashmere which was removed and collected by an industrial vacuum cleaner (Figure 1). Hand combs used in this experiment were an adapted version of the traditional combs used in China. The covers were made from a tube of elastic material which were stretched to reach over goats horns and with holes for the legs.

![Automated combing machine in use on a cashmere doe.](image)

**FIG 1** Automated combing machine in use on a cashmere doe.

**Cashmere Quantity and Quality**

Fibre from groups B, C and E were measured for yield by weight of down (yield percentage) from a random 10 gram subsample using a Shirley Trash Separator at all sample dates. In combed fleeces where harvested weight was less than the required ten grams, fleeces were bulked across two or more harvest dates. These samples were not included in individual harvest date analysis but were included in statistical analysis of total harvested down weights. When pure cashmere samples were difficult to obtain using the Trash Separator, fleeces were recorded as difficult to dehair. Fibre diameter in Groups B and C were measured using the Fibre Distribution Analyser (FDA) at Whatawhata Fibre testing Centre in Group B and C. Two bulked samples representing all fleeces were measured for percentage yield and fibre diameter in Group A and D.

**Cashmere Wastage**

Ten each of shorn, machine and hand combed fleeces were randomly selected from Groups B and E. Following dehaired with the Shirley Trash Separator, waste guard hair was recovered and the proportion of 300 fibres that were less than (cashmere) or greater than (guard hair) 40 micron was determined. A subsample of the recovered guard hair from the ten hand combed fleeces was hand separated to determine the actual percentage yield of cashmere lost in the guard hair during dehaired. A projection microscope was used to measure fibre diameter in recovered guard hair of shorn and machine combed fleeces and in non dehaired shorn fleeces from the same ten goats in Group B.

**Processing Efficiency**

After completion of the above measurements on Group B fleeces, shorn and machine combed fleeces from the same goats were randomly bulked into seven groups and passed through the Shirley Trash Separator six times. After each pass the portion of fleece containing down was weighed. If the weight between two successive passes did not change by more than 1%, dehairing was defined as being completed. The number of passes required to reach complete dehairing was compared.

**RESULTS**

**Cashmere Quantity and Quality**

Machine combing was the least effective method of harvesting cashmere (Table 1) with a half fleece of 18.5 grams of down compared with shorn half fleece of 40.4 grams (P<0.001). No differences were present in weight of down harvested by these two methods for dry and pregnant does. The ineffectiveness of the machine combing was further illustrated in Group D where whole fleeces harvested by machine combing produced only 33 grams of down compared with the whole shorn
fleeces of 75 grams (Group A). Hand combing was more effective than machine combing and harvested a whole fleece of 46±5 grams (Group E).

**TABLE 1** Total down weight of half and full fleeces* for all treatment Groups. Means with the different superscripts are significantly different at 5% probability level.

<table>
<thead>
<tr>
<th>HARVESTING METHOD</th>
<th>TREATMENT GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shorn 4 August 1989</td>
<td><strong>75</strong>*</td>
</tr>
<tr>
<td>Machine Combed</td>
<td>40±4*a</td>
</tr>
<tr>
<td>Hand Combed</td>
<td>18±2*c</td>
</tr>
<tr>
<td>Covered: Shorn 3.10.89</td>
<td>27±4*ab</td>
</tr>
<tr>
<td>Machine Combed</td>
<td>39±6*ab</td>
</tr>
<tr>
<td>Hand Combed</td>
<td>33*</td>
</tr>
</tbody>
</table>

**TABLE 2** Cashmere percentage yield by weight of treatment B, C and E.

<table>
<thead>
<tr>
<th>HARVESTING METHOD</th>
<th>TREATMENT GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shorn 4 August 1989</td>
<td>28±2*F</td>
</tr>
<tr>
<td>Covered: Shorn 3 October 1989</td>
<td>28±4*F</td>
</tr>
<tr>
<td>Combed 4 August 1989</td>
<td>65±2*C</td>
</tr>
<tr>
<td>Combed 29 August 1989</td>
<td>63±2*C</td>
</tr>
<tr>
<td>Combed 3 October 1989</td>
<td>49±2*D</td>
</tr>
</tbody>
</table>

Means with the same superscript are not significantly different at 5% probability level.

Only 9 of the 40 goats in Group C retained their covers for the duration of the experiment. Data from these 9 goats only is presented. The covered half shorn fleece on 3 October of 27±4 grams tended to be lower (P<0.12) than the half fleece shorn on 4 August of 39±6 grams.

The mean yield of down in shorn whole and half fleeces in Groups B and C was 27±1%. Yields of down from combed fleeces were more than double that of shorn fleeces with hand combed fleeces overall (Group E) having an overall higher yield at 65±2% compared with machine combed fleeces with a yield of 58±1% (P<0.001). The harvested fleeces by machine and hand combings conducted on 4 and 29 August were more than 14 and 27% units higher yielding respectively than the 3 October combing (Table 2). The fibre diameter of down from combed fleeces and shorn fleeces were similar at 16.8±0.2 micron.

![Graph](image)

**FIG 2** Change in yield of shorn and combed fibre following additional passes through a shirley trash separator.

### Cashmere Wastage

A greater proportion of down fibres were removed with the guard hair during dehairing of combed fleeces. Down fibres comprised 79±5% and 63±8% of machine and hand combed fleeces respectively while in shorn fleeces down fibres comprised only 29±3% of the fibres in the waste guard hair (P<0.001). Hand separation of subsamples of hand combed fleeces showed that the percentage yield of cashmere found in the waste guard hair was 20±20%. There was a relationship between the percentage count of cashmere fibres and the percentage by weight yield of cashmere in the waste guard hair (P<0.001). The equation describing this relationship was:

\[ YC\% = -6.5 + 0.0059 NCF^2 r=0.87 \]

where

- **YC%** = Percentage yield by weight of cashmere fibres
- **NCF%** = Percentage count of cashmere fibres
Prior to dehairing shorn samples had a mean guard hair fibre diameter of 89±1 micron and following dehairing of shorn fleeces the mean fibre diameter of the waste guard hair was similar at 90.8±0.7 micron. However the waste guard hair of machine combed fleeces was coarser at 100.0±0.7 micron (P<0.001).

Only 8% of the combed fleeces were characterised as difficult to dehair while 28% of the shorn fleeces were recorded as being difficult to dehair.

Processing Efficiency

Dehairing was completed after 5 passes through the Shirley Trash Separator in both shorn and combed fleeces (Figure 2). In pass one (P<0.001) and pass two (P<0.05) a greater amount of guard hair was removed from shorn fleeces than combed fleeces. Thereafter the change in yield percentage was similar in both combed and shorn fleece (P<0.52).

Kidding Results

The does started kidding in early September 1989 and had largely completed kidding by early October 1989. Fifty eight percent of does were scanned as being pregnant, 47% of the does kidded. The kidding drop in does kidding was 125% and the weaning percentage was 115%. The method of harvesting cashmere had no effect on doe liveweight on 3 October.

DISCUSSION

Machine combing was the least effective of the four methods of harvesting cashmere studied in this experiment. Hand combing and covering were equally effective but both were inferior to shearing. It is likely that the effectiveness of combing could be improved if shedding could be synchronised and down was shed over a condensed period. While pregnancy and lactation are known to suppress cashmere growth (Graham, 1988) there was no synchronisation of shedding following kidding in this experiment. It is possible kidding at an earlier date may be more effective at synchronising shedding.

The covers used in this experiment were not suitable for cashmere goats grazing hill country as only a small number of the covers were retained. In the goats which retained their covers down weights harvested were low largely due to down losses at the extremities of the cover. There was no indication that this fibre would not be suitable for processing due to excessive rotting.

Despite the higher yield of combed fleeces the dehairing requirements were the same for combed and shorn fleeces. Dehairing of combed fibre using the Shirley Trash Separator results in a greater loss of cashmere fibres in the waste guard hair than occurs in shorn fleeces. This underestimate of the true yield of the combed fleeces undoubtedly contributes to the apparent ineffectiveness of combing. However the magnitude of this effect as determined from hand separation of waste guard hair provides only a partial explanation of the low down weights harvested by combing. No definitive data has been published by processors on losses of cashmere during commercial dehairing machines though processors state that losses are higher in shorn fibre due to second cuts.

Efficient dehairing requires a large difference in fibre diameter between the fibre types. While no differences in fibre diameter were identified in the cashmere portion of the fleece harvested by combing and shearing, the guard hair of combed fleeces were on average 9 micron coarser than shorn fleeces and suggests that the comb was pulling out coarser guard hairs differentially. This would result in a greater fibre type differentiation in combed fleeces. Neither were combed fleeces more difficult to dehair. The explanation for the greater level of cashmere wastage in combed fleeces is not the result of fibre differentiation or more difficult dehairing and at this time remains unexplained.

CONCLUSIONS

Shearing was the most effective method of harvesting cashmere as evaluated in this experiment. Machine combing was the least effective with covers and hand combing being intermediate. No processing advantages in terms of cashmere wastage or speed of dehairing could be identified for combed fleeces. In fact combed fleeces had higher levels of cashmere wastage than shorn fleeces.
ACKNOWLEDGEMENTS

The authors thank Helen Dick for her assistance in the preparation of the graph and statistical analysis of this experiment and Phil Spring for the measurement and counting of fibres conducted using the projection microscope. We are also grateful for the additional measurements provided by the Whatawhata Fibre Testing Centre and appreciate of the farm staff at the Wanganui Hill Research Area for their assistance in stock management and combing of the goats.

REFERENCES


