**Short communication**

**Divergent selection for reproduction affects dag score, breech wrinkle score and crutching time in Merinos**

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**Abstract**

Merino lines that were divergently selected from the same base population from 1986 to 2009 for their ability to rear multiples were assessed for dag score in autumn and spring, breech wrinkle score, and crutching time. Animals in the Low (L) line had higher dag and breech wrinkle scores and took longer to be crutched than High (H) line contemporaries. Expressed relative to H line least squares means, means of L line individuals were respectively 54%, 65%, 42% and 40% higher for autumn dag score, spring dag score, breech fold score, and crutching time. Gender effects for dag score were inconclusive, as ewe hoggets were more daggy than rams in autumn, with an opposite trend in spring. Shearer (n = 6) also affected crutching times, with an almost twofold difference in mean crutching time from the quickest shearer (27.7 ± 3.1 seconds) to the slowest shearer (49.4 ± 3.7 seconds). The inclusion of dag score and breech wrinkle score as linear covariates in an analysis on crutching time eliminated the effect of selection line. It thus seems that the quicker crutching times of H line animals may be related to line differences for dag score and, to a lesser extent, for breech wrinkle score.

**Keywords:** Reproduction, selection lines, shearing time, wrinkle

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Dags are accumulations of faecal material around the tail and crutch (breech) of sheep and are associated with sheep with loose, moist faeces that adhere to the wool (Reid & Cottle, 1999; Waghorn et al., 1999). Dags can accumulate to form large masses that cover the whole rear end of a sheep, and even become dried without falling off. Woolly crutches collect wet faeces and urine, especially if there are crutch wrinkles, and if the bare skin at the breech has not been stretched by mulesing (Fels, 1971). Once dirty, more faeces and urine are collected and patches of skin are kept continuously wet, causing skin irritation and ‘weeping’ of protein-rich fluids from the inflamed skin (Belschner, 1937; Watts & Marchant, 1977; Watts et al., 1978; French et al., 1996; 1998). Increased dagginess intensifies the risk of flystrike (Morley et al., 1976; Watts & Marchant, 1977; Watts et al., 1979; French et al., 1996). This generalisation is reflected in a significant genetic correlation between breech strike and dag score (Greeff & Karlsson, 2009).

Currently a range of practices are employed to control breech strike, including shearing, crutching, tail-docking, jetting and (until recently) mulesing. Shearing or crutching removes dags and moist wool. The
skin is ventilated and dries out, making it less attractive to blowflies (Belschner, 1953). Mulesing as a breech strike prevention method is now considered unethical and it is accepted that it should not be used anymore.

Counsell (2001) suggested that the cost and frequency of crutching would increase without mulesing in Australia. Daggy sheep are an economic burden to farmers because, in addition to direct costs, crutching removes potentially high value wool, which is sold at a heavily discounted price (Meyer et al., 1983; Larsen et al., 1994). Larsen et al. (1995) reported that sheep with increased breech soiling (dag) required significantly more labour to remove the dag prior to shearing. Daggy or stained wool, even when cleaned, carries into the product, causing appearance and performance problems (Scobie et al., 1997). These authors reported that dags in sheep have detrimental consequences to the saleability of livestock in New Zealand owing to the impact on slaughter hygiene. Crutching and shearing were also reported to have animal welfare implications (Scobie et al., 1997). Hargreaves & Hutson (1990a; b) claimed there was no difference in the stressfulness of partial versus complete shearing. They reported that up-ending (tipping the sheep over on its rump) for shearing was, in itself, a stressful procedure.

Divergent selection for reproduction in South Africa resulted in lines that differ in susceptibility to breech strike (Scholtz et al., 2010b). Line differences in terms of breech and crutch cover scores as well as dag scores were reported (Scholtz et al., 2011). This study evaluates the influence of divergent selection for reproduction on crutching time. The influence of gender was studied simultaneously.

Two lines of Merino sheep were divergently selected from the same base population from 1986 to 2009, using maternal ranking values for number of lambs reared per joining, as described by Cloete et al. (2004). Details of the procedure for the selection of replacements have been reported elsewhere (Cloete & Scholtz, 1998; Scholtz et al., 2010b). Briefly, male and female progeny of ewes that reared more than one lamb per joining (i.e. reared twins at least once) were preferred as replacements in the High (H) line. Replacements in the Low (L) line were preferably descended from ewes that reared fewer than one lamb per joining (i.e. barren, or loss of all lambs at least once). Depending on average reproduction rates in the lines, and on replacement needs, progeny of ewes that reared one lamb per joining were occasionally selected in either line. Selection decisions were based mostly on ≥3 maternal joinings, especially for rams.

The resource flock was maintained at Elsenburg Research Farm. The climate, pastures and management of the animals were described by Cloete et al. (2004), while lambing and reproduction practices in the breeding flock were described by Cloete & Scholtz (1998). The climate at the experimental site is Mediterranean, with a winter lambing season (June–July). The animals used in this study were the 2006 Merino lamb drop. All animals were tail-docked at the third palpable joint at approximately three weeks of age and shorn in September–October as weaner lambs to remove the halo hairs of the lamb fleece. According to standard husbandry practices, ewes and rams were separated at approximately seven months of age, and subsequently managed as separate flocks. All animals were shorn again in May 2007 as hoggets (11 months old). Hoggets were scored for daggs prior to being shorn in May 2007 (autumn dag score). Soon after shearing, the animals were scored for breech wrinkles. All animals were again scored for dags prior to being crutch in September 2007 (spring dag score) when they were approximately 15 months old, using the same scoring system. The Visual Breech Scoring System (Australian Wool Innovation Limited, 2007) was used throughout. During the spring crutching, the time that it took to crutch each individual sheep was recorded. The time it took from the first cut till the crutching process was completed (the last cut) was recorded with stopwatches. Six observers, each representing a shearer, were used to record the crutching times.

Data for dag score, breech wrinkle score and crutching time were subjected to least squares analyses, to account for uneven subclasses (Gilmour et al., 2006). Fixed effects included in all the analyses were selection line (H or L line) and gender (ram or ewe), as well as the interaction between these effects. Shearer was included as an additional fixed effect in the analysis of crutching time. Subsequent analyses on crutching time also included spring dag score and breech wrinkle score as linear covariates. Mean crutching times were derived for categorized dag scores. Because of very low numbers for the extreme scores, dag scores of 1 were pooled with 2, while scores of 5 were pooled with 4 for this analysis. The traits analysed were independent of interactions among selection line and gender and, in the analysis of crutching time, between selection line and shearer (P >0.15). Only main effects were thus included in the final analyses and only main effect means were tabulated.

Animals in the L line had higher dag and breech wrinkle scores and took longer to be crutched than H line contemporaries (all P <0.01). Expressed relative to H line means, least squares means of L line individuals were respectively 54%, 65%, 42% and 40% higher for autumn dag score, spring dag score,
breech fold score and crutching time (Table 1). A line difference for wrinkle score was not unexpected. Cloete et al. (2005) reported a similar result in a previous study on these selection lines for overall wrinkle scores (the sum of neck, body and breech wrinkled scores) where animals from the H line were more plain-bodied than their contemporaries in the L line. Subsequent analyses found near unity genetic correlations between wrinkle scores on different body parts, suggesting that these traits are governed by a largely similar set of genes (Scholtz et al., 2010a). McGuirk et al. (1981) found bloodline differences in time required to shear rams and ewes, mainly owing to skin-wrinkle differences. Scobie et al. (2005) reported an up to 20% increase in the shearing period, directly proportional to the number of blows required for sheep with high wrinkle scores. Wrinkle score is genetically and phenotypically correlated to dag score (Greeff & Karlsson, 2009; Smith et al., 2009). It therefore stands to reason that animals in the L line took longer to crutch. Being wrinkly in the breech area in itself should slow the process down, without the added effect of more dags.

Table 1 Least squares means (± s.e.) for dag score on two occasions, breech fold score, and crutching time in relation to selection line and gender

<table>
<thead>
<tr>
<th>Effect</th>
<th>Number of observations</th>
<th>Dag score</th>
<th>Breech wrinkle score</th>
<th>Crutching time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Autumn</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>Selection line:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H line</td>
<td>131</td>
<td>1.47 ± 0.06</td>
<td>1.81 ± 0.09</td>
<td>2.25 ± 0.07</td>
</tr>
<tr>
<td>L line</td>
<td>18</td>
<td>2.25 ± 0.17</td>
<td>2.99 ± 0.24</td>
<td>3.20 ± 0.20</td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ram</td>
<td>75</td>
<td>1.58 ± 0.14</td>
<td>2.79 ± 0.20</td>
<td>2.50 ± 0.17</td>
</tr>
<tr>
<td>Ewe</td>
<td>74</td>
<td>2.42 ± 0.12</td>
<td>2.01 ± 0.16</td>
<td>2.95 ± 0.14</td>
</tr>
</tbody>
</table>

**P <0.01.

Crutching time was related to dag score (P <0.01), with mean crutching times of 30.3 ± 3.8 seconds for dag scores of 2 and lower, 32.1 ± 2.6 seconds for dag score 3; and 50.9 ± 2.8 seconds for dag scores of 4 and higher. When regressing crutching time on dag score, it was shown that an increase of 1 unit in dag score would result in an increase (b ± s.e.) of 7.4 ± 1.0 seconds in crutching time. A corresponding increase of 1 for breech fold score was associated with an increase of 2.3 ± 1.2 seconds in crutching time. Horton & Iles (2007), using a 0 (no dag) to 5 scale, reported a significant increase in crutching time for each unit increase in dag score above 1 and marked effects at dag scores 4 and 5, as were also found in the present study. The literature reports that the presence of dags doubles the time taken to crutch a lamb (Scobie et al., 1999). It is noted that bare area could have an influence on crutching time, but it was not investigated in this study.

Gender effects for dag score were inconclusive, as ewe hoggets were more daggy than rams in autumn, with an opposite trend in spring (Table 1). In a study on scouring in mulesed sheep, Morley et al. (1976) reported that wether lambs tended to be more susceptible to faecal soiling and breech strike than ewes. Horton & Iles (2007) reported that fewer ewes than wethers required crutching in a mixed-gender group. Scobie et al. (2005) reported that a gender effect became apparent, with the wethers developing a significantly higher mean dag score in a study on Coopworth lambs. They ascribed the reason for a higher accumulation of dags in the males to the difference in the bare area around the anus versus the bare area around the anus and vulva in ewes. In contrast, Meyer et al. (1983) reported that the incidence of dags varied widely over ages and seasons, with the highest incidence generally observed among ewes at tail-docking. It is clear that the literature is undecided about the direction of the gender effect on breech dagginess. Several factors, including intestinal parasites (McEwan et al., 1992), some fungal toxins (Fletcher & Sutherland, 1993) and grazing a feed with high moisture content have been associated with dags (Davidson et al., 2006). In contrast, grazing pastures with high tannin concentrations resulted in less dags (Niezen et al., 1998). However, as ewes and ram hoggets were maintained in different flocks, any comparable flock-specific factors could be associated with the inconsistent gender effects. The conflicting results for autumn and spring dag scores should perhaps be seen against this background, and not as true gender effects.
Shearer (n = 6) affected crutching times ($P <0.01$), with an almost twofold difference in mean crutching time from the quickest shearer (27.7 ± 3.1 seconds) to the slowest shearer (49.4 ± 3.7 seconds). In contrast to this result, Horton & Iles (2007) remarked on a small difference in crutching time between the two shearers in their study. Shearing teams from neighbouring Lesotho and the Eastern Cape in particular are predominantly used in South Africa. These teams have a high turnover in terms of human resources. Therefore it is speculated that experience and training within such teams might differ markedly, thus contributing to the difference in crutching time in the present study.

The inclusion of dag score ($P <0.01$) and breech wrinkle score ($P = 0.07$) as linear covariates in an analysis on crutching time eliminated the effect of selection line (least squares means of 33.0 ± 1.0 seconds for the H line and 35.4 ± 3.1 seconds for the L line; $P = 0.40$). It thus seems that the quicker crutching times of H line animals may be related to line differences for dag score and, to a lesser extent, to breech wrinkle score. It thus seems that the welfare of the wrinklier and daggy L line hoggets may have been compromised as far as the effort needed for crutching was considered.

Apart from the obvious benefits for farm profitability of a Merino line with improved reproduction (Olivier, 1999), plainer and highly reproductive Merinos seem to be preferable from a welfare perspective. Previous results indicated that H line animals were less likely to be affected by breech strike (Scholtz et al., 2010b). Apart from these obvious advantages, the present study indicates that the welfare of L line animals is more likely to be compromised by long crutching times, possibly contributing to uncomfortable and lengthy shearing episodes, when compared with their H line contemporaries. These results all contribute to the quest for an ethically and economically sustainable strain of Merinos, as envisaged by Scobie et al. (1997; 1999); James (2006) and Horton & Iles (2007).

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References


