Short communication

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

A.J. Scholtz[1,2#], S.W.P. Cloete[1,3], J.J.E. Cloete[3,4], A.C.M. Kruger[1], J.B. van Wyk[5] & T.C.de K. van der Linde[6]

[1] Institute for Animal Production: Elsenburg, Private Bag X1, Elsenburg 7607, South Africa
[2] Centre for Sustainable Agriculture and Rural Development, Faculty of Natural and Agricultural Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa
[3] Department of Animal Sciences, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa
[4] Cape Institute for Agricultural Training: Elsenburg, Private Bag X1, Elsenburg 7607, South Africa
[5] Department of Animal, Wildlife and Grassland Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa
[6] Department of Zoology and Entomology, PO Box 339, University of the Free State, Bloemfontein 9300, South Africa

Copyright resides with the authors in terms of the Creative Commons Attribution 2.5 South African Licence.
See: http://creativecommons.org/licenses/by/2.5/za
Condition of use: The user may copy, distribute, transmit and adapt the work, but must recognise the authors and the South African Journal of Animal Science.

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
[#] Corresponding author: ansies@elsenburg.com

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

URL: http://www.sasas.co.za
ISSN 0375-1589 (print), ISSN 222-4062 (online)
Publisher: South African Society for Animal Science
http://dx.doi.org/10.4314/sajas.v42i3.9

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 dags 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 crutched 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 wrinkle 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

Effect	Number of observations	Dag score		Breech wrinkle score	Crutching time (s)
		Autumn	Spring		
Selection line:		**	**	**	**
H line	131	1.47 ± 0.06	1.81 ± 0.09	2.25 ± 0.07	31.7 ± 1.2
L line	18	2.25 ± 0.17	2.99 ± 0.24	3.20 ± 0.20	44.4 ± 3.4
Gender:		**	**	0.06	0.06
Ram	75	1.58 ± 0.14	2.79 ± 0.20	2.50 ± 0.17	35.9 ± 2.8
Ewe	74	2.42 ± 0.12	2.01 ± 0.16	2.95 ± 0.14	40.2 ± 2.3

** 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).

Acknowledgements

D. Marang and Z. Stentyi are thanked for their involvement in the maintenance and recordings of the research flock. The establishment and maintenance of the breeding flock would have been impossible without the financial support of the South African Wool Industry and the THRIP programme of the South African Department of Trade and Industry.

References

Australian Wool Innovation Limited (AWI), 2007. 'Visual Breech Scores Guide' Developed by Australian Wool Innovation Limited (AWI) and Meat and Livestock Australia (MLA). Available at www.wool.com.au/publications [Verified 22 February 2010]

Belschner, H.G., 1937. Studies on the sheep blowfly problem. Paper 1. A review of the sheep blowfly problem in New South Wales. N.S.W. Dept. Agric. Sci. Bull. No. 54, 1-60.

Belschner, H.G., 1953. Sheep Management and Disease. Aust. Agric. Livest. Series, Angus & Robertson: Sydney. pp. 141-145.

Cloete, S.W.P. & Scholtz, A.J., 1998. Lamb survival in relation to lambing and neonatal behaviour in medium wool Merino lines divergently selected for ewe multiple rearing ability. Aust. J. Exp. Agric. 38, 801-811.

Cloete, S.W.P., Gilmour, A.R., Olivier, J.J. & Van Wyk, J.B., 2004. Genetic and phenotypic trends and parameters in reproduction, greasy fleece weight and live weight in Merino lines divergently selected for multiple rearing ability. Aust. J. Exp. Agric. 44, 745-754.

Cloete, S.W.P., Olivier, J.J., Van Wyk, J.B., Schoeman, S.J. & Erasmus, G.J., 2005. Genetic parameters and trends for hogget traits in Merino lines divergently selected for multiple rearing ability. Proc. Assoc. Advmt. Anim. Breed. Genet. 16, 24-27.

Counsell, D., 2001. A benefit-cost analysis of the mules operation to the Australian sheep flock. In: Proceedings of the Flystrike and Lice IPM Control Strategies Conference. Ed. Champion, S., Tasmanian Institute of Agricultural Research, University of Tasmania, Hobart. pp. 369-373.

Davidson, B.S., Chaplin, S.J. & Laird, C., 2006. Effect of fibre supplementation on dag formation and flystrike in sheep grazing spring pastures. Aust. J. Exp. Agric. 46, 783-786.

Fels, H.E., 1971. How to control fly strike in sheep. West. Aust. J. Agric. 12, 237-240.

Fletcher, L.R. & Sutherland, B.L., 1993. Grazing ryegrass/endophyte associations and their effects on animal health and performance. Fly strike and faecal contamination in lambs grazing endophyte infected pasture. Proc. 2nd Int. Symp. Acremonium/grass Interactions. pp. 115-124.

French, N.P., Parkin, T.D.H. & Morgan, K.L., 1996. A case study of blowfly strike in lambs. Vet. Rec. 19, 384-388.

French, N.P., Berriatua, E., Kaya, G. & Morgan, K.L., 1998. Case control study of diarrhoea and faecal soiling in two- to six-month-old lambs. Vet. Rec. 143, 408-412.

Gilmour, A.R., Gogel, B.J., Cullis, B.R. & Thompson, R., 2006. ASReml User Guide. Release 2.0. (VSN International Ltd, Hemel Hempstead, HP1 1ES: UK)

Greeff, J.C. & Karlsson, L.J.E., 2009. Opportunities to breed for resistance to breech strike in Merino sheep in a Mediterranean environment. Proc. Assoc. Advmt. Anim. Breed. Genet. 18, 272-278.

Hargreaves, A.L. & Hutson, G.D., 1990a. The stress response in sheep during routine handling procedures. Appl. Anim. Behav. Sci. 26, 83-90.

Hargreaves, A.L. & Hutson, G.D., 1990b. An evaluation of the contribution of isolation, up-ending and wool removal to the stress response to shearing. Appl. Anim. Behav. Sci. 26, 103-113.

Horton, B.J. & Iles, L., 2007. Dag scores and mean crutching and shearing period for mulesed and unmulesed weaners. Int. J. Sheep. Wool. Sci. 55, 48-64.

James, P.J., 2006. Genetic alternatives to mulesing and tail docking in sheep: a review. Aust. J. Exp. Agric. 46, 1-18.

Larsen, J.W.A., Anderson, N., Vizard, A.L., Anderson, G.A. & Hoste, H., 1994. Diarrhoea in Merino ewes during winter: association with trichostrongylid larvae. Aust. Vet. J. 71, 365-372.

Larsen, J.W.A., Vizard, A.L. & Anderson, N., 1995. Production losses in Merino ewes and financial penalties caused by trichostrongylid infections during winter and spring. Aust. Vet. J. 72, 58-63.

McEwan, J.C., Mason, P., Baker, R.L., Clarke, J.N., Hickey, S.M. & Turner, K., 1992. Effect of selection for productive traits on internal parasite resistance in sheep. Proc. N.Z. Soc. Anim. Prod. 52, 53-56.

McGuirk, B.J., Ponzoni, R., Atkins, K.D., Gilmour, A.R., Morley, F.H.W. & Maher, L., 1981. Factors influencing the time required to shear Merino sheep and its importance as a breeding objective. Aust. J. Exp. Agric. Anim. Husb. 21, 387-394.

Meyer, H.H., Harvey, T.G. & Smeaton, J.E., 1983. Genetic variation in the incidence of daggy sheep – an indicator of genetic resistance to parasites? Proc. N.Z. Soc. Anim. Prod. 43, 87-89.

Morley, F.H.W., Donald, A.D., Donnelly, J.R., Axelsen, A. & Walker, P.J., 1976. Blowfly strike in the breech region of sheep in relation to Helminth infection. Aust. Vet. J. 52, 325-329.

Niezen, J.H., Robertson, H.A., Waghorn, G.C. & Charleston, W.A.G., 1998. Production, faecal egg counts and worm burdens of ewe lambs which grazes six contrasting forages. Vet. Parasitol. 80, 15-27.

Olivier, J.J., 1999. The South African Merino performance testing scheme. Rising to the challenge – breeding for the 21st century customer. Beef Industry and CRC for Premium Quality Wool Industry Symposia. Proc. Assoc. Advmt. Anim. Breed. Genet. 13, 119-124.

Reid, T.C. & Cottle, D.J., 1999. Dag formation. Proc. N.Z. Soc. Anim. Prod. 59, 52-54.

Scholtz, A.J., Cloete, S.W.P., Van Wyk, J.B., Misztal, I., du Toit, E. & Van der Linde, T.C.de K., 2010a. Genetic (co)variances between wrinkle score and absence of breech strike in mulesed and unmulesed Merino sheep, using a threshold model. Anim. Prod. Sci. 50, 203-209.

Scholtz, A.J., Cloete, S.W.P., Van Wyk, J.B., Kruger, A.C.M. & Van der Linde, T.C.de K., 2010b. The influence of divergent selection for reproduction on the occurrence of breech strike in mature Merino ewes. Anim. Prod. Sci. 50, 210-218.

Scholtz, A.J., Cloete, S.W.P., Cloete, J.J.E., Kruger, A.C.M., Van Wyk, J.B. & Van der Linde, T.C.de K., 2011. Genetic parameters for breech strike indicator traits and yearling production traits in Merinos. Proc. Assoc. Advmt. Anim. Breed. Genet. 19, 175-178.

Scobie, D.R., Bray, A.R. & O'Connell, D.O., 1997. The ethically improved sheep concept. Proc. N.Z. Soc. Anim. Prod. 57, 84-87.

Scobie, D.R., Bray, A.R. & O'Connell, D., 1999. A breeding goal to improve the welfare of sheep. Anim. Welfare 8, 391-406. (South Mimms: England)

Scobie, D.R., Young, S.R., O'Connell, D. & Gurteen, S., 2005. Skin wrinkles affect wool characteristics and the time taken to harvest wool from Merino and Halfbred sheep. N.Z. J. Agric. Res. 48, 177-185.

Smith, J.L., Brewer, H.G. & Dyall, T., 2009. Heritability and phenotypic correlations for breech strike and breech strike resistance indicators in Merinos. Proc. Assoc. Advmt. Anim. Breed. Genet. 18, 334-337.

Waghorn, G.C., Gregory, N.G., Todd, S.E. & Wesselink, R., 1999. Dags in sheep; a look at faeces and reasons for dag formation. Proc. N.Z. Grassl. Assoc. 61, 43-49.

Watts, J.E. & Marchant, R.S., 1977. The effects of diarrhoea, tail length and sex on the incidence of breech strike in Modified Mulesed Merino sheep. Aust. Vet. J. 53, 118-123.

Watts, J.E., Dash, K.M. & Lisle, K.A., 1978. The effect of anthelmintic treatment and other management factors on the incidence of breech strike in merino sheep. Aust. Vet. J. 54, 352-355.

Watts, J.E., Murray, M.D. & Graham, N.P.H., 1979. The blowfly strike problem of sheep in New South Wales. Aust. Vet. J. 55, 325-334.