Short communication

Production and reproduction norms of fine woolled Merino sheep on natural pastures in the Karoo

W.J. Olivier[1#] and J.A. Roux[2]

[1] Grootfontein Agricultural Development Institute, Private Bag X529, Middelburg 5900, Eastern Cape, South Africa

[2] Cradock Experimental Station, P.O. Box 284, Cradock 5880, South Africa

Abstract

The objective of this study was to establish a fine woolled Merino flock at the Grootfontein Agricultural Development Institute in order to evaluate the production and reproduction performance of fine woolled animals against a control line on natural pastures in the Karoo. Data collected from 1989 to 1999 were used to evaluate the production and reproduction performance of these two lines. It is evident from the results of this study that the control lambs had a slightly better growth rate than the fine woolled lambs. However, body weight and reproduction of the adult ewes did not differ. The fine woolled animals produced significantly less wool compared to the control line. It can therefore be concluded that it would be possible to produce finer wool effectively under natural pastures in the Karoo**.**

Keywords: Fibre diameter, body weight, fleece weight

[#] Corresponding author. E-mail: willemo@gfn.agric.za

During the past two decades there was a shift in the demand for wool away from strong wool to fine wool. The proportion of fine wool (20 µm and finer) in the national clip decreased from 69% in 1951/55 to only 4% in 1976/80 (Marx, 1981). This decrease was mainly due to more emphasis being placed on the selection for quantity of wool produced per sheep in the 1950's and 1960's than on quality.

The price premium paid for finer wool during the 1980's led to more emphasis being placed on the production of fine wool, rather than simply the amount of wool produced per sheep. The increased demand for finer wool and the associated price difference resulted in the proportion of fine wool (20 µm and finer) in the national clip to increase to 9.71% in 1998/99 (Olivier *et al.*, 2002). This shift in the emphasis of wool production led to more attention being paid to the production of fine wool types and the establishment of fine wool projects at the Cradock Experimental Station and at the Grootfontein Agricultural Development Institute.

With the increased demand for fine wool there was a tendency to produce this type of wool under less favourable feeding conditions. The general opinion was, however, that fine wool could not be produced effectively under the extensive and arid farming conditions of South Africa. It is widely known that several wool quality factors such as fibre diameter, fibre length and tensile strength are influenced by the amount of nutrients available to the wool follicles. The amount of wool is in turn a function of fibre diameter and length (Reis & Sahlu, 1994). Several researchers indicated that the effect of nutrition on wool production is mainly expressed in fibre length and diameter (Nichols, 1933; Galpin, 1948; Stewart *et al.*, 1961).

The objective of this study was to establish a fine woolled flock at the Grootfontein Agricultural Development Institute (GADI) in order to evaluate the production and reproduction performance of fine woolled animals against a control group on natural pastures in the Karoo. Data collected on the Grootfontein Merino flock from 1989 to 1999 were used in this study. The flock was kept at the Grootfontein Agricultural Development Institute (GADI) near Middelburg (31°28'S, 25°1'E) in the North-eastern Karoo region of South Africa. GADI is located in the False Upper Karoo (Acocks, 1988) and has an average annual rainfall of 360 mm.

In 1989, 400 Merino ewes with an average fibre diameter of 23.6 µm were randomly divided into two groups of 200 ewes each, a fine woolled (F) and a control (C) line. The F-line was upgraded by being mated

to genetic fine woolled rams from the Cradock Fine Wool Merino stud (CFMS), while the C-line was mated to rams from the Grootfontein Merino stud (GMS).

The production traits analysed for the lambs included birth weight, weaning weight, 15-month body weight, greasy fleece weight, clean fleece weight, mean fibre diameter, clean yield, staple length, pleat score and number of crimps per 25 mm. The ewe flock was shorn annually. Due to the fact that the ewes were being upgraded, the production traits of 1997 and 1998 of the ewe flock were used for the purpose of this study. The same wool traits were analysed as for the lambs. The reproduction traits analysed were conception rate (number of ewes lambed / number of ewes mated), lambing percentage (number of lambs born / number of ewes mated), weaning percentage (number of lambs weaned / number of ewes mated), survival rate (number of lambs weaned / number of lambs born alive), number of lambs born (NLB) and weaned (NLW) and total weight of lamb weaned (TWW) over a ewe's lifetime.

The following fixed effects were included in the model for birth weight: sex, birth status, age of dam (years), year of birth, line (F or C) and the two-way interaction of sex*line. For weaning weight the following fixed effects were included: sex, rearing status (combination of birth and weaning status), age of dam, year of birth, line (F or C) and the two-way interaction of sex*line. The age of the animals (linear regression) at weaning was also included in the model. The same effects as for weaning weight, except the age of the animals, were included in the models for the 15-month body weight and fleece traits. For the production traits of the ewe flock, only year and line were included in the models. The fixed effects of line and number of lambing opportunities were included in the model for NLB, NLW and TWW. The total number of records of the fine woolled and control line lambs available for the analysis for the body weights were 1996 and 1896 and for the fleece traits 1231 and 1113 respectively. For the production traits of the adult ewe flock 377 and 353 records of the fine woolled and control lines were respectively available and 693 and 659 ewe records were respectively available for the reproduction traits.

Least-squares means (LSM) and the standard errors for the production traits and for NLB, NLW and TWW were obtained with the PROC GLM-procedure of SAS and the significance levels between the lines were obtained with the PDIFF-option under the PROC GLM-procedure of SAS (Littell *et al.*, 1991). The line differences in conception rate, lambing percentage, weaning percentage and survival rate were tested for significance with the CHI-Square-procedure of SAS (2006).

The body weights and fleece traits of the lambs from the two lines are presented in Table 1. It is evident from this table that the control line lambs were heavier ($P < 0.05$) than the fine woolled line at birth and performance testing age. The differences in BW at 15 months of age can most probably be ascribed to the fact that the selection intensity for body weight was much higher in the GMS compared to the CFMS.

Table 1 Production traits (± s.e.) of the fine woolled and control lambs

	Fine wool	Control line
Birth weight (kg)	4.28 [a] ± 0.03	4.62 [a] ± 0.0.3
Weaning weight (kg)	24.12 ± 0.16	24.10 ± 0.16
15 Month body weight (kg)	37.92 [a] ± 0.31	38.67 [a] ± 0.31
Greasy fleece weight (kg)	4.12 [a] ± 0.05	4.60 [a] ± 0.05
Clean fleece weight (kg)	2.75 [a] ± 0.03	3.14 [a] ± 0.03
Mean fibre diameter (µm)	18.04 [a] ± 0.06	19.58 [a] ± 0.06
Clean yield (%)	66.62 [a] ± 0.30	68.28 [a] ± 0.30
Staple length (mm)	88.90 ± 0.51	89.92 ± 0.60
Pleat score	7.99 ± 0.07	7.84 ± 0.07
No. of crimps / 25 mm	16.81 [a] ± 0.44	10.93 [a] ± 0.44

[a] - Values with the same superscript differed significantly ($P < 0.05$)

Furthermore, the fine woolled line produced less ($P < 0.05$) but finer ($P < 0.05$) wool compared to the control lambs. The control lambs had a better clean yield ($P < 0.05$) than the fine woolled lambs and fewer crimps per 25 mm ($P < 0.05$) compared to the fine woolled lambs.

The production traits of the 1997 and 1998 adult ewe flock are summarised in Table 2. It is evident from the table that there was no significant difference between body weights of the two lines. The fine woolled ewes produced finer ($P < 0.05$) but less ($P < 0.05$) wool compared to the control line ewes. The fine woolled ewes also had significantly more crimps per 25 mm than the control ewes. There were no significant differences in clean yield, staple length or pleat score between the lines. The decrease in the mean fibre diameter of the control flock can be ascribed to the fact that one of the main selection criteria in the Grootfontein Merino stud was to decrease fibre diameter. The average fibre diameter of the adult ewe flock decreased from 23.9 µm in 1989 to 22.0 µm in 1999.

Table 2 Production data (± s.e.) of the fine woolled and control adult ewes

	Fine woolled ewes	Control ewes
Body weight (kg)	50.45 ± 0.39	51.01 ± 0.40
Greasy fleece weight (kg)	5.04 [a] ± 0.06	5.43 [a] ± 0.06
Clean fleece weight (kg)	3.16 [a] ± 0.04	3.51 [a] ± 0.04
Mean fibre diameter (µm)	19.65 [a] ± 0.11	21.61 [a] ± 0.12
Clean yield (%)	66.29 ± 0.32	65.24 ± 0.33
Staple length (mm)	88.01 ± 0.76	87.56 ± 0.77
Pleat score	8.47 ± 0.07	8.46 ± 0.07
No. of crimps / 25 mm	13.84 [a] ± 0.11	9.13 [a] ± 0.11

[a] - Values with the same superscript differed significantly ($P < 0.05$)

Table 3 Reproductive performance (± s.e.) of the fine woolled and control ewes

	Fine woolled ewes	Control ewes
Conception rate (%)	90	89
Lambing percentage (%)	129	133
Weaning percentage (%)	94	92
Survival rate (%)	73	69
Number of lambs born per ewe	5.5 ± 0.20	5.6 ± 0.19
Number of lambs weaned per ewe	3.66 ± 0.17	3.60 ± 0.17
Total weight of lamb weaned per ewe (kg)	92.6 ± 4.25	91.7 ± 4.20

The conception rate, lambing percentage, weaning percentage, survival rate as well as the lifetime number of lambs born and weaned and the total weight of lambs weaned are presented in Table 3. It is evident from Table 3 that there were no significant differences with regard to the reproduction of the two lines. The relatively low survival rate in both these lines can be ascribed to two main factors. Firstly, most of the deaths of lambs prior to weaning can be ascribed to a *Chlamydia* infection where the ewes lambed on small, irrigated

pastures. Secondly, stray dogs, as well as vermin also caused losses in some years. The total weight of lambs weaned over an ewe's lifetime of the fine woolled and control lines was 92.6 ± 4.25 kg and 91.7 ± 4.20 kg, respectively. The average number of lambing opportunities of both lines was 2.92.

It is evident from the results of this study that at 15 months of age the control lambs were significantly heavier than the fine woolled lambs. However, body weight and reproduction of the ewes did not differ. Furthermore, the control animals produced significantly more wool compared to the fine wool animals. It can therefore be concluded that within the present economic environment it would be possible to produce finer wool effectively under natural pastures in the Karoo. It is, however, important that the other economically important traits, such as body weight, wool production and reproduction must be included in the selection objectives in order to improve or maintain these traits.

References

Acocks, J.P.H., 1988. Veld Types of South Africa. 3rd ed. Botanical Research Institute, Dept. of Agric. Water Supply, South Africa.

Galpin, N., 1948. A study of wool growth. Part II. Mean fibre thickness, density of fibre population, the area of skin covered by fibre, and the mean fibre length. J. Agric. Sci. 38, 303-313.

Littell, R.C., Freud, R.J. & Spector, P.C., 1991. SAS-system for linear models, 3rd Ed. SAS Institute. Inc. Cary, N.C., USA.

Marx, F.E., 1981. Die gehalte van die Suid-Afrikaanse Merinoskeersel oor dertig jaar. Karoo Agric. 2 (1), 13-14.

Nichols, J.E., 1933. Fibre growth phases in a sample of Australian Merino wool. J. Textile Inst. 24, T333-T340.

Olivier, W.J., Olivier J.J., Snyman, M.A., Pretorius, A.P. & Van Heerden M, 2002. Production and reproduction norms of fine woolled Merino sheep on natural pastures in the Karoo. Grootfontein Agric. 5, 29-31.

Reis, P.J. & Sahlu, T., 1994. The nutritional control of the growth and properties of mohair and wool fibres: A comparative review. J. Anim. Sci. 72, 1899-1907.

SAS, 2006. SAS Online Doc, Version 9.1.3. SAS Institute Inc. Cary, N.C., USA.

Stewart, A.M., Moir, R.J. & Schinckel, P.G., 1961. Seasonal fluctuations in wool growth in south Western Australia. Aust. J. Exp. Agric. Anim. Husb. 1, 85-91.