

( )

( )

//

( )

( )

/ ± / / ± / / ± / / ± / / ± /

( ) /

( ) /

/ ( ) /

) /

( )

( ) / (

:

( )



... ( ) :

(

(REML) /

:

( -

( )

:

$$y = Xb + Z_a a + e \quad ($$

$$y = Xb + Z_a a + Z_s s + e \quad ($$

y

b

( )

s

a ( )

e

$Z_s \quad Z_a \quad X$  ( )

---

1. Service sire

---

TWW/EJ

---

$I \ (I) \quad I \ (I) \quad I \ (I) \quad I \ (I) \quad I \ (I) \quad ( \ )$

$I \quad I \quad I \quad I \quad I \quad ( \ )$

---

$$\text{Var}(pe) = I\sigma_{pe}^2, E(pe) = 0$$

$$\text{Var}(y) = Z_a A \sigma_a^2 Z_a' + Z_{pe} I \sigma_{pe}^2 Z_{pe}' + I \sigma_e^2$$

$$r = (\sigma_a^2 + \sigma_{pe}^2) / (\sigma_a^2 + \sigma_{pe}^2 + \sigma_e^2) \quad (r)$$

( )

( ) DFREML

( -

( )

( ) DFREML

( -

(

b

( )

$$E(y) = Xb$$

$$E(a) = E(s) = E(e) = 0$$

$$\text{Var}(a) = A\sigma_a^2$$

$$\text{Var}(s) = I\sigma_s^2$$

$$\text{Var}(e) = I\sigma_e^2$$

$$\text{Var}(y) = Z_a A \sigma_a^2 Z_a' + Z_s I \sigma_s^2 Z_s' + I \sigma_e^2$$

$$\text{Cov}(a, s) = \text{Cov}(a, e) = \text{Cov}(s, e) = 0$$

I,

A,

$\sigma_s^2$ ,

$\sigma_a^2$ ,

$\sigma_e^2$ ,

( ) DFREML

( )

( $\chi$ )

$$y = Xb + Z_a a + Z_{pe} pe + e$$

y

$Z_{pe}$

pe

1. Simplex method
2. Derivative-free restricted maximum likelihood
3. Convergence criterion
4. Likelihood ratio test
5. Permanent environmental effects due to animal

... ( ) :

/ / . .

( )

REML

/ / / ,  
/ / / / /

(P> / )

( / / )

( )

( / )

/ / /

/ / /

/ /

( )

( )

\*

Log L	$s^2$ (s.e.)	$h^2$ (s.e.)	$\sigma_p^2$	$\sigma_e^2$	$\sigma_s^2$	$\sigma_a^2$	
/		/ ( / )	/	/		/	TWW1/EJ
/	/ ( / )	/ ( / )	/	/	/	/	
/		/ ( / )	/	/		/	TWW2/EJ
/	/ ( / )	/ ( / )	/	/	/	/	
/		/ ( / )	/	/		/	TWW3/EJ
/	/ ( / )	/ ( / )	/	/	/	/	
/		/ ( / )	/	/		/	TWW4/EJ
/	/ ( / )	/ ( / )	/	/	/	/	
/		/ ( / )	/	/		/	TWW5/EJ
/	/ ( / )	/ ( / )	/	/	/	/	

$h^2$

$\sigma_p^2$

$\sigma_e^2$

$\sigma_s^2$

$\sigma_a^2$ \*

Log L

s.e. ,

$s^2$



... ( ) :

( / ( ) ( )

/ . / /

/ / / , ( ) / ( )

, ( ) (

( )

/ / / , / ( )

( )

/ , ) ( / / , )

$h^2$	$\sigma_p^2$	$\sigma_e^2$	$\sigma_a^2$	
/	/	/	/	TWW1/EJ
/	/	/	/	
/	/	/	/	TWW2/EJ
/	/	/	/	
/	/	/	/	TWW3/EJ
/	/	/	/	
/	/	/	/	TWW4/EJ
/	/	/	/	
/	/	/	/	TWW5/EJ
/	/	/	/	

( ) / ( ) / ( )

/ / / / / ( ) / ( ) / ( ) /

---

\*

---

$\Gamma_{p12}$	$\Gamma_{e12}$	$\Gamma_{a12}$	$\sigma_{p12}$	$\sigma_{e12}$	$\sigma_{a12}$		
/	/	/	/	/	/	TWW2/EJ	TWW1/EJ
/	/	/	/	/	/	TWW3/EJ	
/	/	/	/	/	/	TWW4/EJ	
/	/	/	/	/	/	TWW5/EJ	
/	/	/	/	/	/	TWW3/EJ	TWW2/EJ
/	/	/	/	/	/	TWW4/EJ	
/	/	/	/	/	/	TWW5/EJ	
/	/	/	/	/	/	TWW4/EJ	TWW3/EJ
/	/	/	/	/	/	TWW5/EJ	
/	/	/	/	/	/	TWW5/EJ	TWW4/EJ

---

$\Gamma_{e12}$   $\Gamma_{a12}$   $\sigma_{p12}$   $\sigma_{e12}$   $\sigma_{a12}$   $\Gamma_{p12}$

\*



## REFERENCES

3. Analla, M., A. Munoz-Serrano & J. M., Serradilla. 1997. Analysis of the genetic relationships between litter size and weight traits in Segurena sheep. *Canadian Journal of Animal Science*, 77: 17-21.
4. Bromley, C. M., L. D. Van Vleck & G. D. Snowder. 2001. Genetic correlations for litter weight weaned with growth, prolificacy and wool traits in Columbia, Polypay, Rambouillet and Targhee sheep. *Journal of Animal Science*, 79: 339-46.
5. Cloete, S. W. P., J. C. Greeff & R. P. Lewer. 2002. Heritability estimates and Genetic and phenotypic correlations of lamb production parameters with hogget liveweight and fleece traits in Western Australian Merino sheep. *Australian Journal of Agriculture Research*. 53: 281-86.
6. Davis, G. H., C. A. Morris & K. G. Dodds. 1998. Genetic studies of prolificacy in New Zealand sheep. *Animal Science*, 67: 289-97.
7. Excel. 2000. Microsoft Excel. Microsoft Office 2000. Microsoft Press.
8. Fogarty, N. M., L. D. Brash & A. R. Gilmour. 1994. Genetic parameters for reproduction and their components and live weight, fat depth and wool production in Hyfer sheep. *Australian Journal of Agriculture Research*, 45: 443- 57.
9. Foxpro. 1993. Fox Holding, Inc. All Rights Reserved. Patent Pending.
10. Hansen, C. & J. N. B. Shrestha. 1997. Heritability and repeatability estimates for ewe productivity traits of three breeds under 8-month breeding cycle and artificial rearing of lamb. *Small Ruminant Research*, 24: 185-194.
11. Harvey, W. R. 1990. Mixed Model Least-Square and Maximum Likelihood Computer Program. PC-2 Version.
12. Henderson, C. R. 1984. Applications of linear models in animal breeding. University of Guelph. Guelph, Ontario.
13. Ligda, Ch., G. Gabriilidis, Th. Papadopoulos & A. Georgoudis. 2000. Estimation of genetic parameters for production traits of Chios sheep using a multitraits animal model. *Livestock Production Science*, 66: 217-21.
14. Matika, O., J. B., Van Wyk, G. J. Erasmus & R. L. Backer. 2001. Phenotypic and genetic relationships between lamb and ewe traits for the Sabi sheep of Zimbabwe. *South African Journal of Animal Science*, 31: 215-22.

15. Meyer, K. 2000. DFREML. Version 3.0, Program to estimate variance components by restricted maximum likelihood using a derivative-free algorithm. User notes. Animal Genetic and Breeding Unit. University of New England, Armidale. NSW. Mimeo pp.84.
16. Nelder, J. A. & R. Mead. 1965. A simplex method for function minimization. *Computer Journal*. 7: 145-151.
17. Olivier, W. J., M. A. Snyman, J. J. Olivier, J. B. Van Wyk & G. J. Erasmus. 2000. Direct and correlated selection response in Merino sheep with selection for total weight of lamb weaned. *Proceeding 36th SASAS Congress, Stellenbosch*.
18. Pearson, A. M. & T. R. Dutson. 1991. Growth regulation in farm animals. *Journal of Advances in Meat Research*, 7: 629-32.
19. Powell, M. J. D. 1965. An efficient method for finding the minimum of a function of several variables without calculating derivatives. *Computer Journal*. 7: 155-162.
20. Purvis, I. W. 2001. Genetic improvement of reproduction rate in the context of a Merino enterprise. The University of Western Australia, Australia.
21. Rosati, A., E. Mousa, L. D. Van Vleck & L. D. Young. 2002. Genetic parameters of reproduction traits in sheep. *Small Ruminant Research*, 43: 65-74.
22. Schoeman, S. J., S. W. P. Cloete, G. Duguma Jaleta & G. F. Jordaan. 2002. Genetic parameters estimates for ewe lifetime productivity in a Merino sheep flock. *7th World Congress on Genetics Applied to Livestock Production, Montpellier, France*, 8: 33.
23. Snyman, M. A., J. B. Van Wyk, G. J. Erasmus & J. J. Olivier. 1997. Genetic parameter estimates for total weight of lamb weaned in Afrino and Merino sheep. *Livestock Production Science*, 48: 111-16.
24. Snyman, M. A., J. B. Van Wyk, G. J. Erasmus & J. J. Olivier. 1998. Genetic and phenotypic correlations among production and reproduction traits in Afrino sheep. *South African Journal of Animal Science*, 28: 74-81.