An Evaluation Of The Ratio of Lambs Weight to Ewe Weight As An Indicator of Ewe Efficiency

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Introduction

Improved ewe productivity is a major objective in sheep industry and could be achieved by increasing the number of lambs weaned and weight of lambs weaned per ewe per year (Duguma et al., 2002). The total weight of lamb weaned per year is the best single measure of a flock's productivity (Snyman et al., 1997). However, these individual traits can be combined into indices to express the total apparent biological productivity. There are many ways to evaluate the ewe efficiency and one of that is the ratio of kg of litter weaning weight per kg ewe live weight at weaning. A number of variations of this ratio have been adopted with perhaps the most common one being the use of metabolic weight ($W^{0.75}$) as the denominator. Ratios of this kind favor small ewe. This is important because the heaviest ewes produced heavier lambs at birth and at weaning (Ray and Smith, 1966) and the selection for litter weaning weight will increase the mature weight of ewes. However large ewes present a most expensive maintenance cost.

The purpose of the present report was to estimate genetic parameters for traits related to ewe productivity in a commercial multibreed flock.

Material and methods

Source of Data. The data bank analyzed had 14 years (1996-2009) of information, from Gaasa Agropecuária Ltda., a flock supported by Programa de Melhoramento Genético de Caprinos e Ovinos de Corte (GENECOC – Breeding Program for Meat Goats and Sheep) of Embrapa Caprinos e Ovinos (Embrapa Goats and Sheep). This flock is located at Inhumas-Goiás (Altitude de 770 m, Latitude 16º 21' 28'' S and Longitude 49º 29' 45" W, and climate Tropical Semi-Humid). Lambs were fed with maize silage and ration (corn bran and soy bran) with 21% of crude protein (CP). Ewes, rams and confined animals were fed with Tifton 85 pasture, silage and ration with 15% of CP. Breeding seasons occurred continuously all year, with ewes grouped by lots. The genetic groups of ewes were: Dorper (purebred, ½ and ¾), East Friesian (purebred and ½), ½ Hampshire Down, Ile-de-France (purebred and ½), ½ Lacaune, Poll Dorset (purebred, ½, ¾ and ⅞), ¾ Primera, ½ Samm, Santa Inês (purebred, ½, ¾ and ⅞), Brazilian Somali (purebred, ½ and ¾), Suffolk (purebred and ½), ½ Texel, White Dorper (purebred, ½ and ¾).

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Statistical analyses. (Co)variance components for litter weight at birth (LWB) and at weaning (LWW), weight of ewe at weaning (EW) and ratio of kg of litter weaning weight per kg ewe metabolic weight at weaning (WEE = $LWB/EW^{0.75}$) were analysed using restricted maximum likelihood (REML) methodology applied to an animal model. The relationship matrix included 24,590 animals. Of these, 118 were rams and 5,509 were ewes LWB and LWW were analysed in a two-trait model while EW and WEE were analysed in a single-trait model. The models included fixed contemporary group effect defined by year-season-lambing order-birth type-sex of ewe subclass (lambing order – 1 to 8; birth type – single, twin and triplet; sex - one male lamb, one female lamb, two male lambs, two females lambs, one male lamb and one female lamb or more than two lambs, independent of sex), age of ewe at weaning as covariate (linear), fixed genetic group effect, additive genetic difference among breeds (expected proportion of genes from Santa Inês breed), direct heterosis effect, individual recombination loss effect, random animal direct effect, random individual permanent environmental effect and random residual effect. In this study the crossbreeding parameters (genetic breed differences, direct heterosis, and recombination loss) were fitted as covariates in the models, following Hirooka et al. (1998). According to Van Vleck et al. (1987), correlationships among breeding values may be considered as the proper definition of genetic correlations. Thus, genetic correlations between some traits were estimated as Pearson's correlation between ewes breeding values.

Results and discussion

The number of observations, observed averages and crossbreeding parameters for the traits analyzed are presented in Table 1. The numbers of observations for EW and WEE were lowest because only in recent years EW passed to be taken in this flock. Duguma et al. (2002) reported an average of 24.3 kg for LWW in first the lambing of Merino. This value is greater than that presented in this study. Matika et al. (2003) observed averages of 19.6 kg and 35.9 kg for LWW and EW, respectively, in Sabi sheep. Iñiguez and Hilali (2009) estimated averages for LWW, EW and kg lamb weaned per kg ewe body weight ranging from 19.8 to 23.1 kg, from 47.3 to 49.1 kg and from 0.42 to 0.48, respectively, in Awassi genotypes. Using the averages of their study the WEE will range from 1.07 to 1.28.

Additive effects of Santa Inês breed were significant for all traits with positive contributions, except to WEE. Genetic breed differences were evaluated in deviation of this breed due its major participation in the flock (almost 85% of ewes have Santa Inês genes). Direct heterosis was significant for LWW and EW. Bittante et al (1996) also observed important effect of heterosis in LWW in crossbreeding between Finnsheep and an Alpine sheep breed. Crossbred ewes presented largest EW and weaned biggest kg of lambs. Recombination loss was important for EW and WEE.

Estimates of heritability and genetic correlations are shown in Table 2. Rosati et al. (2002) reported heritability of 0.40 and 0.17 for LWB and LWW for purebred, composite and crossbred sheep. These values were higher and lower, respectively, than observed here. Duguma et al. (2002) also estimated a lower heritability (0.20) for LWW over four lambing. In Sabi sheep, Matika et al. (2003) reported heritabilities values of 0.12 and 0.67 for LWW and EW, respectively. The value for this last trait was higher than estimated here. The heritability for WEE was low. Genetic parameters for this trait were not found in literature. The genetic correlations among the traits were according to expected. The negative correlation between EW and WEE indicates that heaviest ewes did not produced heavier litter at weaning, distinct that reported by Ray and Smith (1966). Actually, in this flock the selection aim produce highest kg of lambs at weaning without increase the mature weight of ewes. This aspect can explain this negative genetic correlation.

Table 1: Number of observations (N), averages and standard deviation (A±SD), additive direct effect of Santa Inês breed (SI), direct heterosis (H) and recombination loss (R) for traits related to ewe efficiency in a commercial multibreed flock

Traits	N	A±SD	SI	H	R
LWB (kg)	13,614	5.07 ± 1.63	0.94*	0.04	-0.17
LWW (kg)	12,456	19.11 ± 6.80	1.76*	4.34*	0.39
EW (kg)	8,156	44.91 ± 8.15	15.67*	8.17*	12.01*
WEE	7,848	1.15 ± 0.37	-0.17*	0.05	-0.19*

* $P<0.05$.

Table 2: Estimates of genetic parameters for traits related to ewe efficiency in a commercial multibreed flock $^{\alpha}$

Traits	LWB	LWW	EW	WEE
LWB	0.26 ± 0.05			
LWW	0.68 ± 0.05	0.32 ± 0.06		
EW	0.37^b	0.30^b	0.37 ± 0.03	
WEE	0.15^b	0.34^b	-0.25^b	0.10 ± 0.02

$^{\alpha}$Heritabilities (_s.e.) on the diagonal and genetic correlations below. ^{b} Estimated as Pearson's correlation between breeding values

Conclusion

These results show the possibility of selection of this commercial flock for ewe productivity. In despite the heritability for WEE is low its genetic correlations with other traits indicate it and LWW as selection criteria for improve ewe productivity without increase ewe mature weight.

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