ABSTRACT: The objective of this study was to estimate genetic parameters for body weight and conformation traits in Santa Inês sheep. A total of 1,272 records from 511 animals born between 1992 and 2013 to 68 rams and 352 ewes, belonging to five herds, were used. The following variables were analyzed: body weight (BW), heart girth (HG), hip height (HH), wither height (WH), rump width (RW), and body length (BL). The variance components were estimated by the REML method in two-trait analysis using an animal model. The model included random direct additive genetic, permanent environmental and residual effects and contemporary group and the linear effect of age of animal as fixed. Heritability estimates were 0.08, 0.25, 0.42, 0.48, 0.32 and 0.24 for BW, HG, HH, WH, RW and BL, respectively. Genetic correlations between weight and body measures were high, ranging from 0.75 to 1.0.

Keywords: variance components; heritability; genetic correlation

Introduction

The Santa Inês breed is widely used in Brazil for meat production because of its adaptation to the climatic conditions, resistance to endoparasites, high rusticity and prolificacy, and reduced reproductive seasonality. However, the production and quality of meat produced by animals of this breed need to be genetically improved. Santa Inês is the most frequently used maternal breed for crossings with more specialized breeds in commercial sheep meat production systems.

The estimation of genetic parameters for body traits should contribute to the establishment of selection criteria for economically important traits in an attempt to render the sheep meat production system more competitive.

The production of lambs is the main objective of meat production systems. The earlier the lambs reach slaughter weight, the better the economic return. Body weight has been the main selection criterion used in elite sheep herds in Brazil. Recent studies have associated morphological traits (e.g., heart girth, hip and wither height, body length, and rump width) with animal weight and some carcass traits (Santana et al., 2001; Pinheiro and Jorge, 2010).

The objective of the present study was to estimate genetic parameters for body weight and body measurements in Santa Inês sheep.

Material and Methods

This study involved Santa Inês breeders of five herds located in the State of São Paulo, southeastern Brazil. The following body measurements were taken monthly from July to December 2013: body weight (BW); heart girth (HG); hip height (HH); wither height (WH); rump width (RW); and body length (BL).

A total of 1,272 records from 511 Santa Inês sheep born between 1992 and 2013 to 68 rams and 352 ewes were used. The data mainly referred to adult females and weaned animals since this experiment was part of a study on nematode resistance. A maximum of four measurements were obtained for each animal from July to December 2013. The relationship matrix contained 1,732 animals.

The variance components were estimated by the restricted maximum likelihood (REML) method in two-trait analysis under an animal model using the MTDFREML program (Boldman et al., 1995).

For all traits, the model included random direct additive genetic, permanent environmental and residual effects, in addition to the fixed effects of contemporary group (herd, month and year of harvest) and the linear effect of age of animal at measurement. The animal’s age was divided into different classes: monthly classes until 12 months since the main development of the animal occurs during this period; bimonthly classes for animals aged 12 to 24 months, and quarterly classes for animals older than 24 months.

Results and Discussion

Table 1 shows the heritability estimates obtained with the two-trait animal model for weight and body measurements. In general, the heritabilities for the body measurements were of medium to high magnitude, except for...
BW whose heritability (0.08) was lower than that reported by MacManus and Miranda (1998). These authors found heritabilities for weights at different ages in Santa Inês sheep ranging from 0.22 to 0.34. Although weights were mainly measured in postweaned animals, a small proportion of animals (13%) was recently weaned or was in the preweaning phase. Problems with the estimation of variances may have occurred in this case due to the maternal effect which was not included in the model. The low heritability for BW observed in this study indicates that this trait is more influenced by environmental effects, as illustrated in Figure 1.

![Figure 1. Estimates of phenotypic variances (Vp), and proportions of additive genetic variance (Vg), permanent environmental (Vpe) and temporary environment (Ve), for body weight (BW), heart girth (HG), hip height (HH), wither height (WH), rump width (RW), and body length (BL).](image)

The heritability estimates for the body measurements ranged from 0.24 to 0.48. Among these measures, HH and WH exhibited the highest heritability, followed by RW. The heritabilities for HG and BL were of moderate magnitude (Table 1). These results indicate that direct selection for these traits will provide reasonable genetic gains, especially in the height of the animal. An interesting finding was obtained for RW, a trait related to lambing ease, whose heritability indicates its use as a selection criterion. Three of the herds studied consisted of elite animals, in which animals adapted to the Brazilian conditions, i.e., pasture fed with little supplementation, are selected. The other two herds belonged to pasture-based production systems, in which animals adapted to the Brazilian conditions, i.e., pasture fed with little supplementation, are selected. The origin of the animals of this study may explain the high genetic variability obtained for the morphological traits.

<table>
<thead>
<tr>
<th>BW</th>
<th>HG</th>
<th>HH</th>
<th>WH</th>
<th>RW</th>
<th>BL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08</td>
<td>1.0</td>
<td>0.98</td>
<td>0.97</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>0.87</td>
<td>0.25</td>
<td>0.83</td>
<td>0.85</td>
<td>0.94</td>
<td>0.93</td>
</tr>
</tbody>
</table>

All genetic correlations between BW and the body measurements were high and positive, ranging from 0.97 to 1.0 (Table 1). The magnitude of the correlations indicates that selection for BW will result in indirect genetic gains in all body measurements. Weight has been the main selection criterion in both commercial and elite herds. The phenotypic correlations between BW and the body measurements ranged from 0.56 to 0.97.

The results of the present study suggest genetic gains in the traits studied, particularly in the morphological characteristics. It should be noted that the measurement of these traits is of low cost and can be easily obtained by breeders. However, other traits should be considered in sheep meat production systems in Brazil, including traits related to reproductive performance and traits related to adaptability, such as nematode resistance which is a major problem in sheep farming and is also studied in this project. Alternative selection criteria should be investigated in order to obtain more adapted and economically viable animals for sheep meat production systems.

**Conclusion**

The selection currently performed in Santa Inês sheep herds in Brazil should result in an increase of body measurements.

**Literature Cited**