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ENVIRONMENTAL AND GENETIC EFFECTS ON PRODUCTION TRAITS OF EWES ORIGINALLY FROM DISTINCT ENVIRONMENTS

EFEITOS AMBIENTAIS E GENÉTICOS SOBRE PARÂMETROS DE PRODUÇÃO DE OVELHAS ORIGINALMENTE ORIUNDAS DE AMBIENTES DISTINTOS

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SUMMARY

Wool production and reproductive performance components of similar genotypes, brought from distinct production areas, were evaluated during five years trial at similar environments, such as, joining season and stocking rate on winter improved pasture. The least squares means revealed that the origin (breed) effect concentrated upon the Corriedale ewes wool production, whereas in Romney females it affected the reproductive performance. In the abscence of interaction between origin (breed) and year for most variables, it was assumed that the farm management procedures and/or selection criteria applied on hoggets were determinant of the subsequent lifetime production within each genotype examined. Expecting a better reproductive performance in Romneys, mainly rate of lambs born, weaned and lambs weaning weight, comments were made on the selection criteria employed on this breed over many years. The work has demonstrated that "property of origin (breed)" of sheep composing any experiment aiming at breed comparisons, should be considered as a potential factor capable of biasing information on productive aspects.

Key words: sheep, breed, origin, environment, wool, reproduction.

RESUMO

Durante cinco anos, foram avaliados os componentes de produção de lã e eficiência reprodutiva de genótipos semelhantes, trazidos de distintas áreas de produção, mantidos em similares condições ambientais, tais como, época de acasalamento e lotação sobre pastagem cultivada de inverno. As médias pelo método dos quadrados mínimos revelaram que o efeito de origem (raça) concentrou-se, nas fêmeas Corriedale, na produção de lã, enquanto que, nas Romney Marsh, este influenciou a eficiência reprodutiva. Na falta de uma interação significativa entre origem (raça) e ano experimental para a maioria das variáveis, foi assumido que os procedimentos de manejo e/ou critérios de seleção aplicados sobre as borregas nas propriedades de origem, foram determinantes para a subseqüente produção dentro de cada genótipo estudado. Esperando uma melhor performance reprodutiva das origens de ovelhas Romney, no que respeita a taxa de cordeiro nascido, desmamado e peso de cordeiro ao desmame, são feitos comentários sobre o critério de seleção aplicado nessa raça por muitos anos. O estudo demonstrou que, quando raças são avaliadas em ambientes similares, a "propriedade de origem (raça)" deve ser considerada como um fator capaz de introduzir fontes de erros na informação da performance produtiva das raças.

Palavras-chave: ovino, raça, origem, ambiente, lã, reprodução.

INTRODUCTION

Experiments comparing breeds should be conducted under conditions which permit predictions of their performance under commercial management (DICKERSON, 1974). There is always a need of a complete evaluation of variability in production parameters between breeds, as they contribute to the genetic progress that can be made in many years of selection (MAYALA, 1974). Some genetic vs. environmental interactions (DUNLOP, 1962) are quite important, because there is a choice upon both breed and environment that may better suit for a specific objective.

Besides breed comparison itself, these studies are also useful to examine the production respondes within similar genotypes, which become possible in occasions that trials include flocks originally from diverse

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environment. On this aspect concentrated this work. The study on the overall breed comparison has been the subject of other report (OLIVEIRA et al, 1993). The aim of this work was to estimate, at similar environmental conditions, the patterns of production (wool and reproductive performance) derived from flocks of Corriedale and Romney breeds, originally from distinct production areas.

MATERIAL AND METHODS

Data analysed in this work are part of a trial on breed comparison conducted from 1977 to 1981 at Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), located at Bagé, state of Rio Grande do Sul, Brazil.

The ewes studied were acquired as hoggets from different properties (three for Corriedales and two for Romneys) in 1976. In February 1977, flocks of 120 Corriedale and 120 Romney ewes aged about 18-19 months, previously shorn in late November, were randomly divided into 8 groups (two replicates by breed) and joined within the periods of 01 March to 12 April (JS.1) or 15 April to 27 May (JS.2).

All groups, within their respective joining season, grazed together with beef cattle on native pasture until the third or fourth month of gestation. At this time, they were moved onto paddocks of winter improved pastures (**Trifolium** repens and **Lolium multiflorum**) and stocked at two rates: 10 ewes/ha (SR.1) or 15 ewes/ha (SR.2), up to weaning. The number of ewes within each joining season x stocking rate combination was constant (15 ewes), so that SR.1 and SR.2 were obtained by varying paddocks size (1.5 and 1.0 ha, respectively). Table 1 presents the final numbers of ewes studied in each plot (overall years 1977/1981), showing that, within breed, ewes origin was equally represented in each plot.

Wool records taken were greasy fleece weight (GFW), clean fleece weight (CFW) and fibre diameter (FD). Sampling methods and traits measurements followed the methods described in OLIVEIRA & KENNEDY (1992). Reproductive performance, based on ewes joined, was evaluated by the number of ewes lambing (EL/EJ), lambs born (LB/EJ), lambs weaned (LW/EJ) and total lambs weaning weight (TAWW) adjusted to a common 90-day weaning age (LEVINE et al, 1978).

Data were analysed by the method of Least Squares (STEEL & TORRIE, 1981), employing the Mixed Model Least-Squares Maximum Likelihood Computer Program (HARVEY, 1987). The equation described below represents the full model fitted. When non significant, interactions were dropped, and the reduced model included only the main effects and those significant first order interactions.

TABLE 1. Number of ewes within breed, joining season, stocking rate and replicates (overall years 1977/81), regarding different property of origin.

Breed	Corriedale 433				Romney 425			
Join.Season	1	2	1	2				
	217	216	205	220				
Stock.Rate	1	2	1	2	1	2	1	2
	113	104	108	108	98	107	114	106
Replicates	A B	A B	A B	A B	A B	A B	A B	A B
(16 plots)	55 58	52 52	54 54	55 53	54 44	57 50	59 55	54 52
Origin (breed) (40 plots)								
A	12 12	14 16	19 22	11 17				
B	20 21	12 15	21 15	16 10				
C	23 25	26 21	14 17	28 26				
D					25 23	27 30	28 34	29 24
E					29 21	30 20	31 21	25 28

Joining Season 1 = 01 March-12 April
2 = 15 April-27 May
Stocking Rate 1 = 10 ewes/ha
2 = 15 ewes/ha

$$Y_{ijklmn} = u + Y_i + J_j + S_k + B_l + 0(B)_{ml} + YB_{il} + JS_{jk} + JO(B)_{jml} + SO(B)_{kml} + E_{ijklmn}$$

where:

Y_{ijklmn} = an observation of GFW, CFW, FD, EL/EJ, LB/EJ, LW/EJ and TAWW on the n^{th} ewe in the i^{th} year, at the j^{th} joining season and k^{th} stocking rate, from the l^{th} breed and m^{th} property

and:

u = population mean

Y_i = effect of the i^{th} year of measurement (i= 1 (1977), ..., 5 (1981); $\Sigma i = 0$)

J_j = effect of the j^{th} joining season (j= 1 (Mar-Apr); 2 (Apr-May); $\Sigma j=0$)

S_k = effect of the k^{th} stocking rate (k= 1 (10 ewe/ha) ; 2 (15 ewe/ha); $\Sigma k=0$

B_l = effect of the l^{th} breed (l= 1 (Corriedale); 2 (Romney); $\Sigma l=0$)

$0(B)_{ml}$ = effect of the m^{th} origin within the l^{th} breed (m=A,B,C for l=1 and m=D,E for l=2;

$\Sigma m(l)=0$)

YB_{il} ,..., $SO(B)_{kml}$ = first order interactions

E_{ijklmn} = random erros of observations, assumed to be normally distributed ($u=0$ and σ^2).

The model was used to estimate the effects and first order interactions of origin within breed (adjusted for year/age, breed, joining season and stocking rate), using plot means as experimental units, so that there were 200 observations in this plot based analysis (see Table 1). The weighted least-squares analysis was employed, in which percentage data (EL/EJ, LB/EJ and LW/EJ) were transformed by the unitbasis option (HARVEY, 1987). Individual observations were not considered, due to the residual sum of squares would have contributions from interactions not in the model, main plot treatment errors and animals within subplot error, which would be all weighed by degrees of freedom on the error sum of squares, where animals variance would get the highest weight. Although in this analysis the extent of the confounding between the effect of year with both the age at the sampling year and year of birth cannot be predicted, any interpretation on the subsequent performance of different origins within both genotypes and year is not biased since age groups are equally represented in each subclass of origin (breed) vs. environmental effects.

RESULTS AND DISCUSSION

When adjusted for the effects of year, breed, joining season, stocking rate and other interactions (Table 2), origin (breed) was significant on GFW, CFW ($P < 0.01$), LB/EJ ($P < 0.05$) and LW/EJ ($P < 0.01$). The results also revealed that the effect concentrated upon the Corriedales wool production, whereas in Romneys it affected the reproductive performance.

Although all origins in Corriedales were somewhat different in wool production, the within breed difference was due to lower levels of production from sheep of origin A, which had lighter greasy fleece weight (0.18kg and 0.11kg) and clean fleece weight (0.19kg and 0.11kg). Within each breed, differences in mean fibre diameter were not significant and considered of no importance from a point of view of processing performance or end product. Both the origin (breed) vs. joining season and origin (breed) vs. stocking rate interactions for greasy and clean fleece weight in Corriedales were associated with a differential response of ewes from origin B. Related to the overall breed mean, both origins in Romneys were more different in percentage of lambs weaned (21.2%) than in lambs born (10.4%), revealing that ewes from origin D were more efficient not only in lambing, but also in raising their lambs. Once EL/EJ was not different ($P > 0.05$), the data indicate that the significant difference in LB/EJ in Romneys was result of distinct twinning rates between both origins (Table 3).

TABLE 2. Significance level of effects considered in the least squares analyses of variance. #

Effect	DF	Character						
		GFW	CFW	FD	EL/EJ	LB/EJ	LW/EJ	TAWW
Year (Y)	4	**	**	**	**	**	**	**
Breed (B)	1	**	**	**	**	**	**	**
Joining Season (JS)	1	ns	ns	ns	**	**	ns	ns
Stocking Rate (SR)	1	ns	ns	ns	ns	ns	**	ns
Y x JS	4	--	--	--	**	--	**	--
B x JS	1	--	--	--	--	--	--	*
Origin (Breed) O(B)								
Corriedale	2	**	**	ns	ns	ns	ns	ns
Romney Marsh	1	ns	ns	ns	ns	*	**	ns
Y x O(B)								
Corriedale	8	--	--	--	--	ns	--	--
Romney Marsh	4	--	--	--	--	*	--	*
JS x O(B)								
Corriedale	2	**	*	--	--	--	--	*
Romney Marsh	1	ns	ns	--	--	--	--	ns
SR x O(B)								
Corriedale	2	**	*	*	ns	--	--	*
Romney Marsh	1	ns	ns	ns	**	--	--	ns
R^2 Model (%)		57	51	40	47	49	48	30

\# adjusted models
** ($P < 0.01$)
* ($P < 0.05$)
ns ($P > 0.05$)
- not included in analysis

It seems clear that, within each breed, factors inherent to previous flocks management within farms sampled were the major contributors for the differential production response observed. Among them, aspects related to breeding and rearing systems (plane of nutrition) as well as genetic potential differences, probably derived from distinct selection objectives imposed to flocks, could in part explain the trends found. JACKSON & ROBERTS (1970) also reported the stud (strain) effect being important in Merinos, but they found a significant stud (strain) x year interaction, as some studs responded differently in some years. It is thought that, in this study, the absence of a significant origin (breed) x year interaction for most variables has indicated that, within both breeds, the levels of production reached at the properties were carried over the new environment (experimental period), without any remarkable change throughout the years, either on the rank between similar genotypes or on the magnitude of their differences. Therefore, on farm management and/or selection procedures applied on these ewes, when hoggets, were determinant on the subsequent lifetime

TABLE 3. Least squares means of wool production traits and reproductive performance of Corriedales and Romneys ewes according to different origins.

Parameter	Corriedale			Romney	
	A	B	C	D	E
WOOL PRODUCTION					
GFW (kg)	3.36a	3.54 b	3.47ab	3.19a	3.23a
CFW (kg)	2.54a	2.73 b	2.65 b	2.53a	2.61a
FD (#)	29.25a	29.43a	28.36a	34.19a	34.37a
REPRODUCTIVE EFFICIENCY					
LB/EJ (%)	100.6a	106.2a	99.8a	92.0a	82.9 b
TR##	8.5	14.4	9.7	9.7	5.6
LW/EJ (%)	77.4a	74.9a	78.3a	72.1a	58.3 b
TAWW (kg)	19.2a	19.9a	19.8a	21.4a	21.3a

micrometres
Twinning rate
Within breed, between origins: means not followed by common superscript are statistically different ($P < 0.05$)

production within each genotype examined. Similar evidences were found in reproductive aspects of Corriedale males by MORAES et al (1988).

Overall, the results obtained suggest that origin (breed) affected differently both genotypes examined. The results in Table 3 clearly demonstrate that in some circumstances Romneys almost reached the levels of wool production found in Corriedales; however, it would be expected a better reproductive performance in Romneys, mainly rate of lambs born, weaned and lambs weaning weight, when one considers them also as a meat producer breed. In consequence, a question should be made: would not the selection criteria employed on the latter breed over many years (i.e., greasy or clean fleece weight only) be a restrictive element of its reproductive efficiency?

The trends found are true for the properties sampled and should not be extrapolated to both breeds in general. It could be worth, however, to extend such approach to a larger number of properties and/or areas, to better examine the patterns found. Finally, this work has also demonstrated that "property of origin (breed)" of sheep composing any experiment aiming at breed comparisons, should be considered as a potential factor capable of biasing information on productive aspects.

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