LAMB SURVIVAL, COAT SURFACE TEMPERATURE AND GROWING PERFORMANCES IN RELATION TO BIRTHCOAT TYPE AMONG DIFFERENT GENETIC TYPES RAISED OUTDOORS

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INTRODUCTION

Sheep meat industry in France is currently changing and leaving intensive agricultural areas for less favourable lands. Rejecting the classical choice of hardy low-performing animals in harsh environment, opposite to high-productive animals in favourable conditions, Bouix *et al*. (2002) proposed to study some genetic strategies allowing good economical results in difficult areas such as permanent exposure outdoors in mountains areas. The different breeds used in the proposed crossbreeding schemes show a large variability in the fleece type from hairy in the Romanov breed to the fine medium crossbred fleece of the "Berrichon du Cher" breed leading to a high variable birthcoat type in crossbreds lambs. Some previous works had shown association of the birthcoat type and lamb survival (Purser and Karam, 1967). The aim of the present study was to quantify lamb survival in relation to the birthcoat type and its protective aptitude concerning heat loss in crossbred lambs issued from different genetic strategies and raised under permanent exposure outdoors from birth.

MATERIAL AND METHODS

General experiment context. The experiment was conducted on the INRA farm of La Fage on the Causses-du-Larzac, a calcareous plateau in the south of France. As previously described (Bouix *et al*., 2002) the main characteristics of this high-altitude territory (800 m) is arid conditions despite of an abundant annual rainfall of 1000 mm, due to an important permeability of the soil, which feeds deep subterranean rivers. Seasons are highly contrasted with cold winter due to the altitude and hot summer due to the southern latitude with intermediate seasons showing high variations in temperature, wind and rainfall. To take account of the between-year variability, and also to get a sufficient number of animals, the experiment was 5 years long from 1995 to 1999.

Breeding system and lambing conditions. The breeding system yet described (Bouix *et al*., 2002) is characterized by a short lambing period in outdoors conditions from end-March to mid-April. Climate conditions at that period can abruptly vary from severe conditions of low temperature, wind and rain or snow to warm and sunny conditions.

Animals. The experiment design is built around the local breed Lacaune (L) characterized by large-sized animals with high aptitudes for milking and growth performances, a medium prolificacy and a poor muscular development and having a medium crossbred fleece. The Romanov (R) is a small-sized and highly prolific breed with a hairy fleece ; its conformation is very bad. The experimental lambs are issued from the two pure breeds and their reciprocal crossbreds RL. Rams of the Berrichon-du-Cher (BCF) or the Charmoise (CHA) meat breeds both bearing a fine crossbred fleece were used for procreate terminal crossbred lambs with

ewes of the previous types : R, L and RL. Additionally, rams from the Inra401 (I) breed, a synthetic line issued by crossbreeding over several generations R and BCF breeds were used with RL ewes in 1999 (table 1).

Data recorded. At birth within the first 12 hours and at about 10 days, lambs were weighted, sexed, assessed for birthcoat type and measurements of coat surface temperature were made. Then lamb mortality was recorded at daily interval up to weaning at about 50 days of age. Lambs were again weighted at the age of 30 and 50 days and coat depth measured at 90 days.

Classification of birthcoat type. The system of grading birthcoats consist of assigning lambs to one of the three grades or types on the basis of the distribution, density and length of halo or guard hair determining composition and structure of the coat at birth. The three grades are as follows :

Type 3 : dense and long hairy double coat.

Type 2 : hairy apparent single coat (no distinction about the length of different fibre types).

Type 1 : fine and short woolly coat with no or a few halo hairs on the posterior part of the body.

Coat surface temperature were determined with an infrared radiothermometer, a special portable equipment used to determine temperature without contact by measuring radiative heat flow. To take into account variations in the ambient temperature, measurement of surface temperature from a cement-sheet roofing material maintained dry at ambient temperature was undertaken. Measurements were made at birth from 1995 to 1997, and at about 10 days later from 1997 to 1999.

Data analysis. Data were analysed by ANOVA with the GLM procedure of the SAS package. The considered fixed effects were the birthcoat type, sex, rearing*birth type, and genetic type of lambs, age of dam and year of production, with a simple additive model. The GENMOD procedure was used for analysing the survival rate of lambs. Coat surface temperature was analysed by including surface temperature of the control material as covariate in the model.

RESULTS AND DISCUSSION

Variability of birthcoat type among the different genotypes was shown on table 1.

Table 1. Number of experimental lambs and distribution (%) of birthcoat type within the different genotype breeds

Lamb Genotype		N of Lambs	% birthcoat type within genotype		
			Fine short coat (SW)	Hairy single coat (HS)	Hairy double coat (HD)
Romanov	(R)	45	2.2	71.1	26.7
Lacaune	(L)	482	80.9	8.7	10.4
R*L or L*R	(RL)	478	3.8	45.2	51.0
BCF * L	(BL)	33	93.9	0.0	6.1
BCF * R	(BR)	157	1.3	82.2	16.5
BCF * RL	(BRL)	655	51.3	22.9	25.8
CHA * RL	(CRL)	446	78.5	9.6	11.9
Inra401 * RL	(IRL)	223	31.8	17.5	50.7

Most of Romanov breed, BR and RL lambs had an hairy coat at birth while in Lacaune and BL ones, more than 80 % of the lambs were bearing a short woolly coat (SW). In terminal crossbred lambs issued by crossbreeding RL ewes with BCF, CHA and Inra401 rams, about ½, ¾ and 1/3 of lambs respectively bore a fine and short woolly coat. Such an experimental design was not defined for studying genetic determinism of birthcoat type in sheep. However, our observations seems to indicate that variability in birthcoat type is probably under the control of a few major genes. Previous studies have suggested that birthcoat hairiness in the New Zealand Romney sheep is under the control of both a dominant and a recessive major genes (Dry, 1956; Dry, 1958). Furthermore, as expected, an hairiness birthcoat is associated with a deep coat at both 10 and 90 days of age (table 2) and QTL's on staple length at 90 days of age have been recently shown (Allain *et al*., 1998 ; Ponz *et al*., 2001). These latter chromosome segments affecting coat depth could be involved in the genetic control of coat hairiness at birth.

Table 2. Means, standard deviation, tests of significance and lsmeans

	Survival rate (%)				Coat surface temperature (°C)		Coat depth (mm)		Live body weight	Growth ADG[1] (g)	
	2 days	10 days	30 days	50 days	at birth	10 days	10 days	90 days	at birth (kg)	0-30 days	30-50 days
Means	89.1	85.0	83.7	82.9	26.5	24.8	18.0	35.5	3.36	262	257
Residuals	-	-	-	-	2.2	3.1	5.7	7.9	0.60	52	52
Sex	NS	NS	NS	NS	NS	NS	NS	***	***	***	NS
Rearing type	***	***	***	***	NS	NS	*	**	***	***	***
Age of dam	***	***	***	***	NS	NS	NS	NS	***	***	***
Year	***	***	***	***	***	*	NS	NS	***	***	***
Birthcoat type	**	NS	NS	NS	***	***	***	***	NS	***	NS
HD	94.1	88.8	88.1	87.3	25.0	23.2	23.4	41.1	3.43	270	263
HS	92.4	86.0	85.5	84.4	25.1	23.0	22.7	38.6	3.41	277	263
SW	89.3	84.4	83.9	82.6	29.0	26.5	11.3	29.6	3.36	261	259
Genotype	**	***	***	***	**	*	*	**	***	***	***
R	96.7	94.2	94.5	93.1	-	-			2.89	229	223
L	82.6	77.6	75.2	73.2	26.8	25.0	17.0	22.7	3.55	278	262
BL	91.3	70.5	71.9	69.9	-	-			4.11	298	289
BR	92.4	90.3	88.9	88.1	-	-			3.09	236	230
RL	91.8	84.9	83.9	83.7	25.4	23.2	20.6	38.8	3.40	277	268
BRL	92.8	86.4	85.1	83.9	26.2	24.4	19.2	36.3	3.61	283	262
CRL	91.5	88.7	88.1	87.3	27.0	23.7	19.7	39.4	3.31	277	265
IRL	93.1	90.5	91.0	90.7	-	24.6	19.2	45.0	3.24	277	294

[1] ADG: Average daily gain

NS: p>0.05; * p<0.05 ; ** p<0.01; *** p<0.001

Lamb survival, coat surface temperature, coat depth and average daily growth (ADG) up to 30 days (table 2) were clearly affected by birthcoat type. Lambs with a fine coat survived less than others, the difference is highly significant during the first two days after birth. Such an association between birthcoat type, survival rate and ADG was correlated to significant differences in coat surface temperature at both birth and 10 days of age indicating that lambs bearing a fine coat had greater loss of body heat and energy reserves than lambs having a hairy fleece, with thereafter significant consequences on growth up to 30 days. Similar results were reported in the Welsh mountain sheep (Purser and Karam, 1967).
Another work undertaken on same experimental farm and harsh conditions from 1990 to 1995 (Bouix *et al*., 2002) concluded that a 3-ways crossbreeding scheme with RL ewes and a meat sheep breed such as BCF was highly performing. Our results are in agreement with this previous work, conclude that other meat sheep breed such as CHA and Inra401 can be also successfully used in the cross breeds scheme and give important information about the essential role of an hairy birthcoat and its positive consequences on survival rate, heat body losses and growing performances. Considerations about any disadvantage of an hairy birthcoat coat on fleece quality can be easily avoid when the income from wool is close to zero.

CONCLUSION

Under harsh environment and permanent exposure outdoors, lambs bearing an hairy birthcoat are more adapted to survive specially around lambing time, and show better growth performance up to weaning than lambs bearing a fine and short woolly coat. The birthcoat type play an essential role concerning heat body loss. Consequently, structure and composition of the birthcoat have to be taken account in any genetic strategy for sheep meat production under harsh environmental conditions. Whether the choice of a well adapted breed or crossbred animals remains a primordial question, a selection programme aiming at increasing coat hairiness at birth have to be developed and could be easily achieved as the determinism of the birthcoat type seems to be under a few major genes and some QTL's probably involved have yet been identified.

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