Organisation of sheep breeding in France -suckling breeds-. III. The Lacaune meat programme.

Mercadier M., Perret G., Bodin L.

in

Gabiña D. (ed.).
Strategies for sheep and goat breeding

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 11

1995
pages 49-59

Organisation of sheep breeding in France - suckling breeds - III. The Lacaune meat programme

G. PERRET
INSTITUT DE L'ELEVAGE
CASTANET TOLOSAN
FRANCE

M. MERCADIER
OVI-TEST
ONET LE CHATEAU
FRANCE

L. BODIN
INRA SAGA
CASTANET TOLOSAN
FRANCE

Résumé

Le schéma de sélection de la race ovine Lacaune développé par la coopérative Ovi-Test concerne 44 troupeaux et environ 15 000 brebis. Les objectifs sont principalement l'amélioration des caractères maternels (prolificité et valeur laitière des brebis) mais aussi le potentiel de croissance des agneaux et leur qualité bouchère. Le schéma est organisé autour de contrats entre la coopérative et les éleveurs pour l'utilisation cohérente des différents outils : Contrôle de performances - Accouplements raisonnés par IA - Rassemblement des jeunes mâles et contrôle individuel de leurs aptitudes bouchères - Testage sur descendance de la prolificité mis en place en ferme par insémination artificielle - Système de reproduction des jeunes agnelles normalisé - Evaluation génétique centralisée, etc. De façon originale, les mâles sont tous propriété collective des sélectionneurs. L'observation stricte des règles que se sont fixées les éleveurs a permis de dégager un important progrès génétique.

Mots-clés: Ovin, amélioration génétique, schéma de sélection, prolificité.
Keywords: Sheep, genetics, breeding, selection scheme, prolificacy.

1. Motivations and objectives

The Lacaune breed with 1.29 million ewes occupies the first position among French sheep breeds. It is divided into two main branches with different specialisations and utilisations, i.e. milk production and suckling lamb production (65 and 35 %, respectively of the females). However, females in the milk sector have long been used for the renewal of females in the meat sector and some of them have been subjected to terminal crossing with meat breeds.

In 1975, using the experience acquired in genetic improvement of milk production, the Artificial Insemination Cooperative (OVI-TEST) on request of its members, which are specialised meat sheep producers, determined a breeding programme involving on-the-farm progeny testing of rams from the suckling Lacaune breed with the aim of increasing natural prolificacy and milk producing value as an additional trait. It should be recalled that during the 70ies, genetic improvement of prolificacy by natural oestrus was an alternative to the improvement by hormonal treatment (FGA + PMSG).

Thus, using a specialized strain, OVI-TEST can now disseminate AI doses - or rams - and ewe-lambs to specialized farmers enabling them to make a better use of the maternal abilities of a flock often managed at an accelerated rhythm with 3 lambings in 2 years.

The good growth potential and to a lesser extent the good skin quality of the breed, which justify purebreeding, should also be emphasized.

The last few years, the Lacaune breed also has to meet the quality requirements of lamb carcasses in terms of conformation and fatness. We shall see how they are taken into account in the OVI-TEST scheme by in - station performance testing of young rams and more recently, by progeny testing (carcasses).

2. Number of farms and animals in the scheme

In 1991, 44 farms (15000 ewes) were directly involved in the breeding scheme. Being all located in the Aveyron they are at a distance of less than 100 km from the AI centre. Among these farmers, 20 (7125 ewes) have signed a breeder's contract. They make performance testings for reproduction, control the growth of suckled lambs (estimation of the milk producing value of the dam from 10-30g daily mean gain, DMG) and carry out flock renewal matings with paternity control. These farms participate in planned testings and matings and are liable to supply young males to the scheme via the Performance Testing Station (SCI).

The number of farms in this breeding base have been slightly increasing the last ten years with however a certain turnover of breeders. Thus, among the 20 breeders which were potentially suppliers of sires, 17 participated in the scheme 5 years ago and only 7 10 years ago. Furthermore, the health constraints mainly related to Visna Maedi reduce the number of flocks liable to supply sires to SCI and to the AI centre. A "Testing Support" section was created in 1989 to increase the testing capacities. At the present time, 24 farmers (7987 ewes) belong to this section. They have a special contract enabling them to participate in the sire progeny testing but not in the supply of young males.

The breeding scheme involves a base of 7125 ewes for the development, accumulation and dissemination of genetic progress but with a testing capacity of 15112 females in 44 farms. In 1991, there were 3113 ewe-lambs for the renewal, i.e. 26 % of the number of adults. Among these ewe-lambs, 1713 were daughters of improvement sires and 1380 were testing daughters for progeny testing of 38 sires (36 ewe-lambs/ sire)

3. Rearing and reproduction systems

Lacaune ewes are hardy enough to be kept in semi-open air conditions. They remain in sheep pens during the winter, and after lambing, they are taken out every day to graze the pastures or rangelands. The lambs are suckled by their dams and kept in the sheep pen until slaughter at the age of 3 months. The good milk producing value of Lacaune ewes, makes it possible to exteriorize the high growth rate of lambs, to prevent their early weaning and to limit the artificial feeding with increasing litter size.

The goal of breeders is to increase the numerical productivity of their flock rather than to sell breeding animals. Since the development of the scheme, they have thus adopted an accelerated lambing frequency (3 lambings in 2 years) with 3 mating periods per year. These matings have been standardized over three seasons to improve the quality and efficiency of the indexation. Hence, this leads to a low number of levels for season effect in the indexation

models, an easier organization of the experimental protocol for testing (mating schedule), more rapid collection of more homogeneous results with time and thus a better management of ram cohorts. These periods correspond to different moments of the breeding seasons in Lacaune ewes.

- Out-of season mating from 1/3 to 30/4
- Early breeding season mating from 1/6 to 15/8
- Full breeding season mating from 1/10 to 15/12

They define a framework within which each breeder can determine the mating dates for his flock, over a maximum period of 45 to 50 days. During each period, all non pregnant ewes are systematically mated.

Matings for renewal of ewe-lambs take place in March-April and in June-July, and during the same periods there are planned matings for production of young males. In this system, the ewe-lambs born after the October-November matings are generally not retained because the farmers consider that their growth performances are too low during the summer after their birth. Consequently, they are not heavy enough for matings at the age of 7 months and should be subjected to out-of season matings at the age of 11 months. The offsprings of the ewe-lambs being too light, they are not used for renewal of the flock.

The synchronisation of heats and inseminations is not only required in the breeding scheme for a good implementation of testings and for breeders using accelerated lambing rhythms, but is also necessary in terms of animal performances to prevent a too low fertility in out-of season conditions. Most inseminations are carried out on adult ewes in March-April and to a lesser extent in June-July. The October-November mating, which is not useful in this system for flock renewal, is in fact a natural mating with one ram for about forty females.

As regards the ewe-lambs, their first lambing constitutes the base for the indexation of males which can only be efficient if the performances are obtained after natural oestrus since the genetic correlation between natural and induced prolificacy is only 0.4. Hence, the breeders have decided to subject their ewe-lambs to natural mating for the first time in June-July or in October-November at the same time as the adults and at an age of 7 or 11 months according to their season of conception.

The standardization of this breeding system with 3 lambings in 2 years appears to be essential for the organization and overall efficiency of the scheme. However, because of the small number of breeders and because other breeders want to participate in the selection, but with less intensive breeding systems, 2 new systems have been authorized. In the first system, (4 farms ; 1842 ewes.), the females are mated once per year, but the flock is divided into two groups, one with matings in March-April and the other in October-November. In the second system (2 farms ; 706 ewes), the females are only mated once during full breeding season in October-November. These systems are only compatible with the organization of the breeding and are therefore only authorized if :

- the matings correspond to one of the mating periods of the system - 3 lambings in 2 years,

- the first mating of ewe-lambs is a natural mating at 7 or 11 months during the same breeding periods as the adults,
- the breeders accept to make inseminations during renewal matings, even during full breeding season

Because of the use of these new systems in the scheme, planned matings (production of young males) and testings take place over the three periods.

4. Contract programme (Table 1)

For the implementation of its genetic improvement programme, OVI-TEST applies the usual means, i.e. on-the-farm performance testing, planned matings, individual performance testing stations for young rams. However, its specificity and rigour depends on the fact that it controls the reproductive events in each flock:

- the rams belong to the cooperative
- the breeders do not sell any male for reproduction
- OVI-TEST defines the mating plan for the two main operations, i.e. planned matings and performance testing
- artificial insemination is required for each step and has repercussions in terms of a wide dissemination of genetic progress.

Besides, the breeders are obliged :

- to participate in the performance testing and to accept the rules defined by UPRA (Unité Nationale de Promotion de la Race, National Union for Breed Promotion)
- to observe the health regulations defined by the cooperative.

In turn, for the engagements taken by the breeders, OVI-TEST provides a guarantee for:

- supplying the rams or the AI semen doses required for the mating plan
- purchasing the performances: for each tested ewe-lamb - (prolificacy, milk producing value), a sum of money is paid to the breeder (31 F in 1991).
- reserving the best improvement sires for breeders using performance testing so that there is no dissemination of these sires to breeders who do not use the scheme. For example, in 1991, 4 sires were reserved.
- giving priorities to inseminations and applying preferential tariffs.
- adhering to UPRA on behalf of the breeder.

5. Testing operations

5.1. Planned matings with ram dams

The qualification of ram dams is not definitive as it is determined every year by the National chain of on-the-farm performances, on criteria defined by the scheme. These dams must exhibit at least two lambings, prolificacy and milk producing value indexes exceeding

0.06 and 0.70[1], respectively, a lambing rhythm above 0.9 /year, and a gross prolificacy above 2 lambs/lambing. In 1991, the breed file contained 1703 ram dams, i.e. about 17% of the a priori useful flock for creation and accumulation of genetic progress. However because of the unavailability of females for mating, only 1335 were inseminated by elite rams. Furthermore, because of health constraints and index modifications between the moment of mating and lambing only 428 of these ram dams were liable to produce young males.

5.2. Performance testing station for young rams

The technical assistant responsible for the scheme selected 219 young lambs in the farms, 50 - 80 days after lambing. Most of them derived from planned matings are potentially intended for performance testing, others from matings between ancestry of immediately lower genetic values are intended for dissemination. The genetic levels of the ancestry (table 2) clearly show the priority given to breeding of maternal abilities (positive index, prolificacy and milk producing value).

These lambs are then purchased and sent to the individual performance testing station. OVI-TEST thus controls the quality of rams required in the scheme. The other item consists in evaluating the meat producing abilities of the lambs: growth, weight at 130 days, fatness at 45 kg, conformation in terms of muscle development.

When calculating the index according to a methodology defined by INRA (National Institute for Agricultural Research) it is possible to make a mass selection aiming at eliminating the poorest breeding animals so that the breed can remain competitive in the sector of meat lamb production: 37 young rams eliminated in 1991, i.e. 16 % of the lambs entering the scheme.

This objective is confirmed by the mean values of the indexes of rams maintained for performance testing in 1991: values close to zero (average) for growth traits, weight and conformation. However, priority is given to fatness.

After having chosen in priority rams for testing, the remaining rams are available for sale to breeders out-of the breeding base.

5.3. Testing

The 54 rams chosen for testing by a commission of breeders were trained to mount, their semen was collected and its quality checked. Animals intended for testing being exclusively used in AI, 16 males which were unfitted for AI were eliminated and used for natural mating in the selection base. The 38 other animals were then employed for the first time at the age of 7 or 8 months to produce their testing daughters.

The experimental protocol for performance testing is established by OVI-TEST. Each sire is planned to inseminate about hundred females of medium value distributed over 8 flocks, on an average (min.=3 ; σ=3), each flock receiving semen from 8 different sires. This design generates good connections which are enhanced by inseminations performed with some very good elite rams (≈5) on ram dams. Each ram is used on a small number of females (≈8) per flock, but in a large number of flocks (≈14).

---

[1] Female index values in the population :

prolificacy :	μ=0.0	min.=-0.20	max.=0.40	σ=0.07
milk producing value	μ=0.0	min.=-3.00	max.=3.00	σ=1.00

Table 1 : Clauses of the testing contract

	Breeder "breeding base"	Breeder "testing support"
Identification of flock	Yes	Yes
Performance testing	Reproduction and milk producing value	Reproduction
Paternity control	AI and natural mating to produce 100 % of the renewal	Per AI to produce at least 50 % of renewal females
Mating plan	For all females of the flock	Minimum of 50 AI/flock
defined	35 % of dams with improvement sires per AI	50% of dams with improvement sires
by	35 % of dams with testing sires per AI	50% of dams with testing sires
OVI-TEST	30 % non renewal females	
Rate of renewal	25 % mated females 12% testing sire daughters, 13% improvement sire daughters	
Standardized management of reproduction	On all females of the flock	On ewe-lamb dams, and ewe-lambs
Mating of ewe-lambs	At 7-8 months or 11 months, in June-July or Oct.-Nov. in natural mating only	Idem
Production of renewal rams	Yes, by AI	No
Destination of young males	Transfer to OVI-TEST or sale to butchers	Butchers

Table 2 : Origins and genetic levels of young males in individual performance testing stations in 1991

Ram values	At entry	Choice for testing	Rams really tested per AI
Number	219	54	38
Dam:			
Lambs/year	2.12		2.22
Prolificacy index	+0.11		+0.14
Milk produc.value index	+0.43		+0.45
Sire:			
Qualifications :			
"Improvement"	84%		100%
"Testing"	16%		-
Prolificacy index			+0.14
Milk produc.value index			+0.44
Individual values			
Growth index		-1 g (10 g)	-0.1 g
Weight at 130 d index		+0.4 kg (2.0 kg)	+0.8 kg
Fatness index at 45kg [1]		+0.06 (0.12)	+0.07
Conformation index		0.00 (0.25)	+0.04

(..) Standard deviation of the index of candidates
[1] a positive value corresponds to a leaner animal and is thus a favourable value.

These testing inseminations (3487 AI in 1991) result in the birth of ewe-lambs among which the breeders can make their choice (2/3 retained) for the renewal of the flock. According to the experimental design, most sires obtain their testing daughter within a single breeding season, the purpose being to get a large enough number of performances in a minimum of time and thus to obtain a good indexation and selection. Because after this insemination campaign the sires remain unproductive in the AI centre before announcement of the results. The connection between successive cohorts is obtained by the repeated utilisation of improvement sires.

Testing ewe-lambs have to be mated for the first time in the natural way in order to improve the accuracy of the genetic value of their father. To that end, they are batch mated by a single ram for 35 - 45 days with 25 - 35 ewe-lambs per ram. The latter made available to the breeders by OVI-TEST, are either indexed males of poor genetic quality or males unfitted for AI but fertile in natural mating, or young lambs chosen when leaving the SCI. Breeding animals born from these matings are never retained.

5.4. Breeding evaluation

Since 1992, the indexation of males and females is made jointly with a multivariate animal model considering the performances obtained after natural (variable 1) and induced (variable 2) oestrus for all females of the population. This model takes into account year, flock, season effects as well as the age of the female, its mode of birth, litter size and number of lambs suckled after the former lambing and the interval between previous lambing and fertilisation. These indexes which are calculated in a central site (INRA-CTIG, Jouy en Josas) for all sheep breeds are regularly sent to OVI-TEST which determines animals to be retained or eliminated among the newly indexed males. Among the cohort of 37 rams tested in 1989, 31 were indexed for the first time in 1992; they exhibited a mean precision of the prolificacy index (DC) of 0.37 (minimum=0.20). OVI-TEST choose 4 in order to increase the flock of elite males which each year produces the new cohort of young males.

5.5. Qualification of breeding animals

The identification and performance testing of the animals, on the one hand and the indexation of breeding animals, on the other hand are performed by bodies under national wardship and independent of the implementer of the selection scheme. Ewe and ram evaluation results are supplied to OVI-TEST which on account of its breeding goals chooses the animals to be eliminated. These choices are then examined and generally confirmed at two levels:

- by UPRA which provides the breeding animal with a label
- by the commission of public mating which approves the results of the rams disseminated by AI.

6. Genetic potential of the ram population

At the present time, the cooperative has 215 rams of which 112 are awaiting for testing results and 103 have indexes which are already known. Among the latter, 71 have at least one insufficient index and they are used in the different farms for natural mating the products of which are not retained for renewal of the flock (matings of ewe-lambs, return after AI). The other 32 (table 3) remain at the AI centre and constitute the population of ram and ewe sires of the scheme.

Table 3 : Distribution of prolificacy and milk producing value indexes of males of the AI centre (22* = improvement rams ; **10** = elite rams ; *4* = reserved rams)

Milk value / Prolificacy	Total	<-1.0	-1.0 à -0.6	-0.6 à 0	0 à 0.6	0.6 à 1	>1.0
Total	32	2	8	10*	10*	1*	1*
>0.25	10	1	2	**4**	*3*		
0.10 à 0.25	12		4	4	1+**2**	*1*	
0 à 0.10	8	1	2	2	2		1
<0.0	2				2		

They can be divided into three categories according to the combination of their prolificacy and milk producing value indexes.

- Ram sires or elite rams (n=10) exhibit the best indexes; their semen is mainly intended for procreation of young males. The best of the latter (n=4) are reserved exclusively for the breeders and cannot be disseminated outside the scheme.
- Improvement rams are used in the breeders' flocks and in the rest of the populations to procreate renewal ewe-lambs. Let us recall that for inseminations in the different flocks it is OVI-TEST which attributes the rams to the breeders. The choice being to distribute origins and benetic values between flocks and to increase the connections

7. Dissemination of genetic progress

The maximum genetic and economic exploitation of ram control and testing operations depends on the diffusion of AI doses from improvement rams to the breeders of the selection base - 3 542 AI- and even more on the sale of doses to the users (8103 AI in 1991). In fact there is a large potential of out of scheme dissemination which is limited by the number rams available at the centre. This dissemination is made over 200 km, beyond the traditional area of Lacaune sheep farming.

In 1991, for natural mating purposes in out-of-scheme flocks, OVI-TEST has also diffused 128 rams, sons of improvement rams, tested in SCI. If requested, the diffusion capacities can be extended.

OVI-TEST can also sell ewe-lambs issued from the selection base but not included in the renewal and the testing ewe-lambs conserved in the flocks. Thus, a maximum of 2 100 ewe-lambs were commercialised in 1991, the demand being higher than the supply. The steady effort in terms of health controls in the farms strengthens this demand.

8. Results

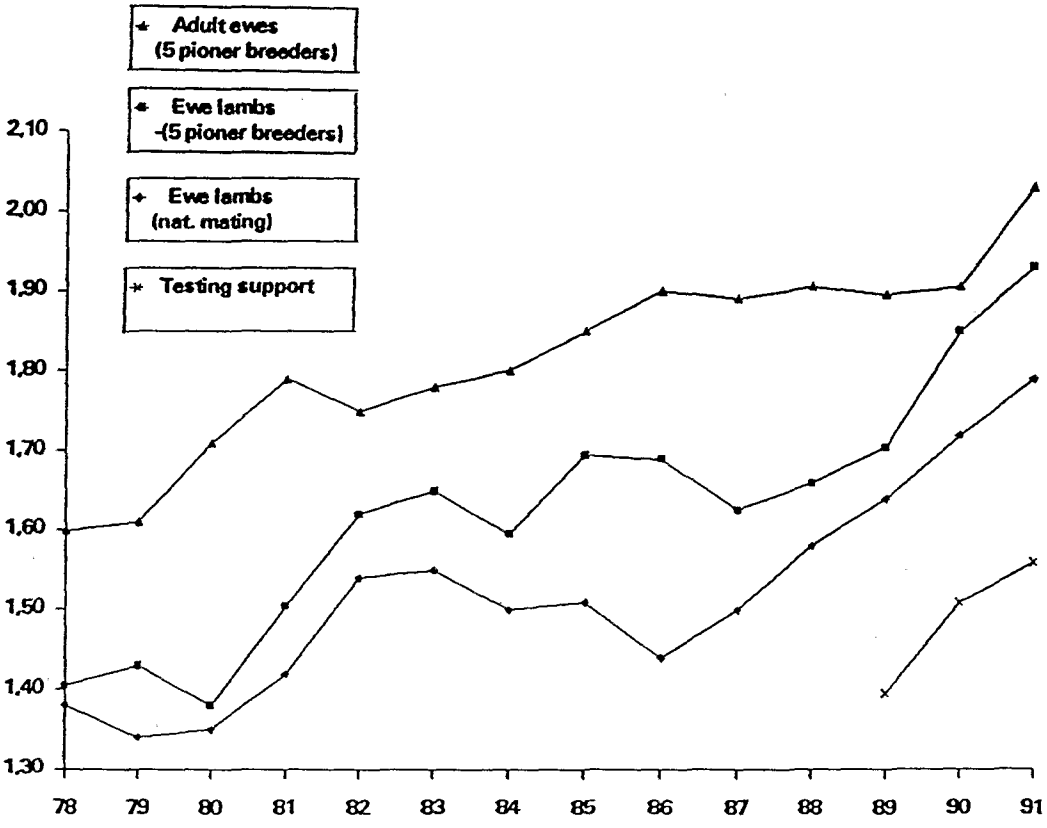
Since the scheme was set up in 1975, 15 series of males have been indexed on their progeny. The development of other rearing systems than that of 3 lambings in 2 years has not affected the breeding data much as they are mainly derived from the results of first mating which is standardized whatever the system. The working rigour of the breeders, their control of sheep rearing and the perrenity of the breeding conditions have led to a large genetic gain. Thus, the prolificacy of the ewe-lambs et their first mating when the scheme was started in 1976 was 1.19. Figure 1 shows the evolution of prolificacy for 3 groups of breeders.

The most ancient 5 breeders having taken profit of the overall cumulated genetic progress, the prolificacy of their ewe-lambs is now 1.93, i.e. a progress of more than 4 % per year over the last 15 years. Because of the turnover of breeders, the average prolificacy (1.79) has progressed a little more slowly. Comparison of ewe-lambs (daughters of the same testing rams) which had lambed in 1989 in the flocks of 'testing support' breeders and in those of all breeders clearly shows the importance of the work done by the latter.

This rise in prolificacy, partly due to the genetic gain, can also be observed in the adults in which prolificacy increased from 1.60 in 1978 to 2.03 in 1991 (in the first breeders). It should however be emphasized that these results have been obtained with females of all ages,

with lambings during 3 very different physiological pericds and in particular with and without hormonal treatments.

Figure 1 : Evolution of prolificacy in the breeding base



Use of the animal model in 1992 makes it possible to estimate the genetic progress obtained in the whole population. This progress is 0.016 lamb per lambing and per year J.P. Poivey, Personal communication), it corresponds to 0.1 genetic standard deviation and shows that selection for this type of trait can be fully efficient.

By contrast, the milk producing value of the dams, which is the complementary breeding trait, did not change. Thus, the growth performance of the lambs remains around 300 g/day for single males and 250 g/day for twin males both suckled by their dam. It is important to take this character into account as the proportion of ewes with multiple litter sizes is high and because in the present economic situation the dams have to suckle their progeny.

9. Prospects

After a constant effort of genetic improvement of prolificacy which has led to substantial results, the breeders and directors of the scheme are confronted with two main questions concerning which investigations are in progress

The increase in natural prolificacy has led at the same time to increasing litter size variability. At the present time, 17 % of lambs from ewe-lambs are singles and 38 % are triplets or more (13 % and 59 %, respectively for lambs from adults). There are not only rearing problems due to multiple births (artificial rearing, mortality, ...) but also problems due to the variable modes of birth (diversity of growth and requirements, range of ages at

slaughter, ...), and the breeders are to day arising questions as to the choice of adequate objectives.

In the search for a larger breeding efficiency and for possibilities of reducing the variability of litter size at birth INRA and OVI-TEST have undertaken observations on the natural ovulation rate and embryonic mortality in the females belonging to the breeders' flocks. Since, it has been well established that an increase in this embryonic mortality increases the variability of litter size and, at equal litter size, reduces the birth weight of the lambs.

To cope with carcass quality demands, OVI-TEST decided to go beyond the in-station individual performance testing of rams by performing progeny testings in some of the rams evaluated for maternal (mothering) abilities. This testing is performed on ewe-lambs of the dairy sector used as a support. The lambs are weaned, fattened at a fattening unit, slaughtered and their carcass controlled. This programme started in 1990. The following year, 23 rams were indexed. Improvement rams for meat production are then available for the cooperative, but it is only in 1992-1993 that some of them will become improvement rams for maternal abilities. This might give rise to problems in terms of strategy of ram utilisation. As a matter of fact, they are not all tested on the 2 types of traits and the indexes are not obtained simultaneously .

The scheme is changing towards a mixed breeding system (maternal abilities -meat producing abilities) and if OVI-TEST intend to maintain the breeding intensities on maternal abilities, the number of rams to be tested should necessarily be increased.