

From: PROCEEDINGS OF THE WORLD CONGRESS
ON SHEEP AND BEEF CATTLE BREEDING
Volume I: Technical

First published 1982
Edited by: R.A. Barton and W.C. Smith

*Published by The Dunmore Press Limited, P.O. Box 5115, Palmerston North,
New Zealand*

40 GENETIC PARAMETERS OF DATE OF LAMBING IN 'DLS' SHEEP¹

M.H. Fahmy

Agriculture Canada, Lennoxville Research Station, P.O. Box 90, Quebec J1M 1Z3, Canada

SUMMARY

A crossbreeding-selection programme was initiated in 1965 by combining genes from the Australian Dorset, Canadian Leicester and Suffolk breeds (DLS). The objective is to develop a new breed with a long breeding season which can reproduce all-year round. The only criterion of selection is an index based on date of lambing in the first 2 consecutive lambings following mating seasons which last from June to November. The selection is direct on the males with rams from the highest ranking ewes being kept for mating and indirect on the females with those in the upper half of the population being kept for a third lambing. Records on about 1 300 ewes representing 4 generations of selection have been used to calculate the repeatability and heritability of date of lambing, using different methods. The correlation of date of lambing between first and second, first and third and second and third lambings was 0.33, 0.25 and 0.13, respectively. The heritability was estimated from paternal half-sibs at 0.14 and from maternal half-sibs at 0.43. The correlation between 86 pairs of full-sibs gave a heritability estimate of 0.70. The heritability, estimated from the intra-sire regression of 693 of daughter-dam pairs was 0.40 ± 0.07 .

INTRODUCTION

The short breeding season of sheep, which in Canada lasts from September to December, is a serious constraint to the development of a viable sheep industry. Consequently, there is considerable interest in developing a breed of sheep with an extended breeding season, thus giving the breeder an opportunity to control the lambings to conform to market demands.

Such a breed is presently being developed in Quebec by selecting for date of lambing using a synthetic population of $\frac{1}{2}$ -Dorset, $\frac{1}{4}$ -Leicester and $\frac{1}{4}$ -Suffolk sheep (DLS). The objective of the present paper is to report on some genetic parameters of date of lambing.

¹ Research paper contribution No. 107.

analyses were carried out within year of birth-year of records, then pooled across years.

- (iii) *Full-sibs*. Calculated as double the inter-class correlation from 86 pairs of full-sibs from the 4 generations.
- (iv) *Regression of daughter on dam*. Calculated as double the regression coefficient from 693 daughter-dam pairs. The regression was calculated within 68 sires (of breeding group when more than 1 sire was used). The regression was also calculated ignoring the sires.

RESULTS AND DISCUSSION

The repeatability of date of lambing averaged 0.33 between first and second records. It was lower between first and third and second and third records averaging 0.21 and 0.13, respectively (Table 1). It must be mentioned that the correlations between first and third, and second and third records were calculated only on the selected ewes (the best 50% in each year), while that between first and second records was calculated on all the ewes present, which explains the difference in the number of ewes in Table 1. The repeatabilities calculated for the ewes with 3 records by the intra-class correlation gave estimates which were very close to the average of the 3 correlations.

TABLE 1: Repeatability of date of lambing.

Generation	First and second lambings		First and third lambings		Second and third lambings	
	No.	Estimate	No.	Estimate	No.	Estimate
1	404	0.31	197	0.10	197	0.10
2	361	0.31	250	0.34	250	0.31
3	362	0.36	160	0.18	160	0.04
4	181	0.34	57	0.39	57	0.20
All generations	1 308	0.33	664	0.21	664	0.13

The repeatability estimates found in the present study are in close agreement with those reported by Ruegg *et al.* (1967) for different breeds (0.36 and 0.33 for 2 flocks of Southdown ewes, and 0.42 for a flock of Hampshire ewes). These estimates suggest that date of lambing is a moderately repeatable trait.

MATERIALS AND METHODS

The programme was initiated in 1965 when 24 pregnant Dorset ewes were imported from Australia. Over a period of 3 years the male lambs out of these ewes were distributed to Leicester and Suffolk breeders in Quebec. All female and some male lambs were bought back from the breeders and raised at the Lennoxville Research Station. For 4 years (1966 to 1969) Dorset-Leicester rams were mated to Dorset-Suffolk ewes and Dorset-Suffolk rams to Dorset-Leicester ewes to produce the first generation of DLS (Dorset-Leicester-Suffolk) sheep. In all, there were 571 Dorset-Leicester and 142 Dorset-Suffolk ewes for the crossing. The DLS-selected line has since been interbred to produce successive generations. So far 4 generations of selection have been completed.

The selection flock is composed of about 500 breeding ewes. Two hundred of these are lambing for the first time, 200 for the second and 100 for the third time. The latter 100 ewes are those with the highest performance, kept to contribute superior progeny to the flock. Two hundred young females are raised every year to replace the 200 ewes removed from the flock (100 culled after second and 100 after third lambings). Since 1968, about 1 300 ewes have been completely tested.

The breeding season starts on 1 June and lasts until 1 November each year. The ewes are exposed to the rams when they are about 15 to 19 months old. They are divided into groups of 25 to 30 and each group is penned with 1 or more rams. The rams are replaced every year with selection for mating being based on the index of their mother, date of birth, growth and twinning, in that order.

The index calculated for each ewe is based on date of lambing. The first of January is considered as day 1; ewes lambing before that date are given a positive value whereas those lambing thereafter receive a negative value. The index is the sum of the performance of the 2 first lambings and it serves as the basis of selection. More details on this experiment and some preliminary results were reported by Fahmy (1976).

Statistical Procedures

The repeatability of date of lambing was estimated as the inter-class correlation between first and second, first and third and second and third records. The correlations were calculated initially within year of birth for each generation, then pooled across year of birth and generations, respectively.

The heritability of date of lambing index was calculated using 4 methods.

- (i) *Paternal half-sibs*. Using the index of the ewes of generation 1, the heritability was calculated as $4\sigma_s^2 / \sigma_s^2 + \sigma_e^2$ from a least squares analysis. The model adopted included the effects of year of birth, sire within year (σ_s^2) and ewe within sire within year (σ_e^2).
- (ii) *Maternal half-sibs*. Calculated as 4 times the inter-class correlation from 116 pairs of maternal half-sibs from the 4 generations. The

The heritability of date of lambing was estimated as 0.14 ± 0.04 from paternal half-sib analysis on the ewes of generation 1 (Table 2). The estimate was calculated also from maternal half-sibs as 0.43 ± 0.24 and from full-sibs as 0.70 (Table 2). The high estimates from these latter methods may indicate the presence of an important dominant and/or maternal effect.

TABLE 2: Heritability of date of lambing index.

Method of estimation	No. records	h^2	S.E.
Paternal half-sibs ¹	51 sires (338 ewes)	0.14	0.04
Maternal half-sibs	110 pairs	0.43	0.24
Full-sibs	86 pairs	0.70	—
Regression daughter-dam	695 pairs	0.40	0.07
Intra-sire regression daughter-dam	693 pairs (68 sires)	0.40	0.07

¹ Data from generation 1 only.

The heritability calculated from doubling the regression of daughter on dam was 0.40 ± 0.07 whether calculated within sire or ignoring sires (Table 2). This estimate is higher than that of 0.25 ± 0.06 reported by Thrift *et al.* (1971).

The genetic parameters calculated from the present data indicate that date of lambing is a moderately heritable trait. Consequently selection should be effective in inducing changes in the population. The selection study within the Southdown breed reported by Thrift *et al.* (1971) showed that over a period of 13 years, date of lambing became 2.6 days earlier per generation. The preliminary results on the DLS selection experiment showed that date of lambing advanced about 3 days per generation which corresponds fairly well with the work of Thrift *et al.* (1971).

REFERENCES

- Fahmy, M.H., 1976. Sheep Canada Magazine, 1: 20.
 Ruegg, S.E. (Jr.), Glimp, H.A., Dutt, R.H. and Woodfolk, P.G., 1976. Kentucky Anim. Sci. Res. Rep. 170: 72.
 Thrift, F.A., Dutt, R.H. and Woolfolk, P.G., 1971. J. Anim. Sci., 33: 1216.