STUDIES ON INBREEDING IN SHEEP

II.— The Effects of Inbreeding on Tail Length and Mortality Rate of No-Tail Lamps

By

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SUMMARY

Breeding records kept by the South Dakota Agriculture Experiment Station on a flock of no-tail sheep covering a period of 13 years and five generations were analyzed. This investigation was carried out to study the effects of inbreeding of lambs, dams and sires on tail length and on mortality rate of lambs.

It was found that an increase of 10 per cent in the inbreeding of lambs, inbreeding of dams and inbreeding of sires caused a decrease of 1.10, 0.81 and 0.73 inches in tail length at birth of lambs, respectively. All values border on statistical significant. Inbreeding had no specific effect on the mortality rate of lambs.

INTRODUCTION

The long tail is a well fixed character in practically all breeds of sheep in the United States. There are no statistics on the percentage of lambs that die each year from the infestation of maggots in the tail. Success or failure in sheep production, depends upon systematic attention to the smallest details.

The purpose of the present investigation is to evaluate the effects of inbreeding of lambs, dams and sires on tail lenght and mortality rate of no-tail lambs.

MATERIAL AND METHODS

The south Dakota Agriculture Experiment Station, U.S.A., imported six representative sheep that belong to the general classification of fat-rumped sheep from Siberia in 1913. None of the individuals imported had any semblance of tail.

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Since that time, the Siberian sheep were used as a foundation stock in order to develop the no-tail sheep by crossing with Hampshire, Shropshire, Cheviot, Southdown and more recently Rambouillet and Columbia breeds. The object or this work was to develop a new breed of sheep in the United States that would not have to be docked and still retain desirable mutton and wool qualities. The no-tail breed of sheep was described in detail by Wilson (1940). Jordan (1952) and Wahlstrom et al (1963).

The data used in the present study were taken from the breeding records for the no-tail sheep flock raised by the South Dakota Experiment Station. Birth tail length records for 750 lambs covering a period of 13 years (1947 - 1960) were used in this study. Tail lenght was measured to the nearest 0.1 inch. Mortality rate was calculated in terms of the percentage of the number of lambs born which survived to 120 days (weaning age). This stage of life was chosen because it is the one where heavy death losses are expected. The methods used in this study to calculate the coefficient of inbreeding were previously reported by Ghoneim and McCarty (1967) The methods suggested by Snedecor (1959) for statistical analysis were followed.

RESULTS AND DISCUSSION

Differences in the lenght and shape of the tail have been used as a basis for classifying the many breeds of sheep found in the world. A few experiments have studied the inheritance of tail lenght in mice. Falconer (1954) found that the heritability of tail length was 60 per cent in mice. He estimated the genetic correlation between weight and tail length to range between 0.57 and 0.62.

Wilson (1940) and Jordan (1952) describing the no-tail sheep, stated that unlike the polled or hornless condition in cattle, tailessness is recessive. They suggested that the no-tail characteristic is not a simple recessive and multiple factors with modifying effects and possibly complementary factors are involved.

Effect of inbreeding of the lamb on its tail length and mortality rate :

Inbreeding of the lambs increased gradually from the first to the fifth generation. Percentage mortality was greater in generations 2 through 5 than in generation 1 (Tabl 1). However, there is no clear indication of a consistent relationship between inbreeding of lamb and percentage mortality. This finding is in close agreement to those reported by Venkatachalam et al(1949) in six breeds of sheep in the United States and Ragab et al (1954) in Egyptian Ossimi and Rahmani lambs. However, the mortality percentage in no-tail lambs is less than that reported by Venkatachalam et al (1949) who showed that it ranged between 42.2% in Cotswold and 18.0 % in Rambouillet sheep.

Tail lenght at birth decreased from 2.02 inches in the generation one to 0.69 of inch in the fifth generation (Table 1) Although tail length of all lambs born in the flock was measured and recorded, yet selection was practiced toward tailessness and therefore a part of the decrement in tail lenght was caused by selection besides inbreeding.

Negative correlations and regressions of tail length on inbreeding of the lamb were found for each of the five generations (Table 2). Most of the estimates were statistically highly significant, while those for the fifth generation were non-significant, and this might be due to the few number of individuals used in this generation. There was also less than 1/2 as much increase in breeding between generations 4 and 5 as between any of the others. However, tail length decreased by 1.62, 1.47, 0.43 and 0.54 inches for every increase of 10 per cent in the inbreeding of the lambs for generations 1 through 4, respectively.

The pooled regression coefficient for all generations (—0.11) was highly significant. On this basis, one would expect a decrease of 1.1 inch in tail length for each increase of 10 per cent in the inbreeding of lambs.

TABLE 1.—AVERAGES FOR INBREEDING TAIL LENGTH AND MORTALITY RATE FOR THE GENERATIONS STUDIED

Generation	Average inbreeding for			Mortality per cent	Tail length		
	lambs %	dams %	sires %		Average length inches	No. of lambs	No. of sires
1	11.6	14.9	11.8	16.7	2.02	90	8
2	16.3	9.1	20.1	20.2	1.59	213	33
3	19.3	14.7	20.4	17.5	1.06	268	19
4	23.2	20.1	18.5	18.4	1.07	152	13
5	24.6	25.0	18.6	18.5	0.69	27	7

TABLE 2.—CORRELATIONS AND REGRESSIONS FOR TAIL LENGTH OF LAMBS WITH RESPECT TO THE INBREEDING OF LAMBS, DAMS AND SIRES.

Generation	d.f.	For inbreeding of lamb		For inbreeding of dam		For inbreeding of sire	
		r	b	r	b	r	b
1	88	—.779**	—.162**	—.415**	—.116**	—.633**	—.162**
2	211	—.493**	—.143**	—.458**	—.097**	—.057	—.019
3	266	—.154**	—.043**	—.262**	—.053**	—.155**	—.039*
4	150	—.223**	—.054**	—.192*	—.066*	—.378**	—.169**
5	25	—.094	—.012	—.203	—.028	—.152	—.038

* $P < 0.05$ ** $P < 0.01$.

Effect of inbreeding of the dams on tail length and mortality rate of their lambs :

The means presented in Table I for inbreeding of dam and percentage mortality of lambs provide no consistent indication that inbreeding of dams had an effect on mortality rate of their lambs in this flock.

Statistically significant negative correlations and regressions of tail length on inbreeding of dams were found for the first four generations. Regressions of lamb tail length per 10 per cent of inbreeding of dams for the first four generations were 1.16, 0.97, 0.57 and 0.66 inches, respectively.

The pooled regression coefficient for the five generations (—.081) was highly significant. On the basis of this estimate, one would expect a decrease of 0.81 inch in tail lenght of the lambs for every increase of 10% in the inbreeding of dams.

Effect of inbreeding of the sires on tail length and mortality rate of their lambs :

No specific trend was observed between the inbreeding of sires and mortality rate of their lambs (Table I). The inbreeding of sires was 20.1% and 20.4% for the second and third generations, while the mortality rate decreased from 20.2% in generation 2 to 17.5% in generation 3. Apparently inbreeding of sires has not been an influencing factor on the lamb mortality in this flock.

Negative correlations and regressions of tail length on inbreeding of sires were noticed for all generations (Table 2). The values for correlation and regession in the first, third and fourth generations were statistically significant. The pooled regression coefficient for the five generations (—.073) was statistically highly significant. A decrease of 0.73 inch in tail length of lambs is expected for each increase of 10 per cent in the inbreeding of their sires.

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دراسات عن تأثير تربية الأقارب فى الأغنام

٢ ــ تأثير تربية الأقارب على طول الذيل
ونسبة النفوق فى الحملان عديمة الذيل

الملخص

استعملت السجلات الخاصة بقطيع من الأغنام عديمة الذيل تربى فى محطة تجارب جامعة سوث داكوتا بأمريكا ، لدراسة تأثير تربية الأقارب على طول الذيل ونسبة النفوق فى الحملان . وتضمن البحث دراسة تأثير معامل تربية الأقارب للحملان والأمهات والآباء على الصفتين السابقتين وشملت الدراسة للسجلات التى تجمعت لمدة ثلاثة عشر عاما فى الفترة بين عامى ١٩٤٧ ــ ١٩٦٠ .

وتوضح نتائج هذا البحث أن زيادة معامل تربية الأقارب للفرد والأم وللأب بمقدار ١٠٪ يصحبه نقص فى طول الذيل بنحو ١٠و١ ، ٨١و٠ ، ٧٣و٠ بوصة فى كل حالة على التوالى . وأتضح أن تطبيق تربية الأقارب من جيل لآخر سبب نقصا فى طول الذيل من ٢٠٣و٠ بوصة فى الجيل الأول الى ٦٩و٠ بوصة فى الجيل الخامس . وعند دراسة تأثير تربية الأقارب على نسبة النفوق ظهر أن تربية الأقارب ليس لها تأثير معين على هذه الصفة .