THE EFFECT OF INBREEDING ON PRODUCTIVITY OF POLISH LOWLAND SHEEP OF THE ZELAZNA VARIETY

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SUMMARY

The effect of inbreeding on productivity of 1522 ewes (born in 1980-1987) from a closed flock of Polish Lowland Sheep of the Zelazna variety was analysed. The average inbreeding coefficient was 3.17% and it varied from 0% to 29%. The inbreeding depression in body weight and fleece weight of ten-month-old ewes was found (b = -0.231 and -0.016 for 1% of inbreeding increase, respectively). A decrease of ewe prolificacy and lamb survival was observed in the group of ewes with a highest inbreeding (>5%), but these results were not statistically significant.

INTRODUCTION

The effect of inbreeding on production in sheep has been analysed for many years. It was found that the inbreeding depression could be observed not only in the ewes' reproductive traits but in body weight and fleece yield as well (Lax and Brown,1968, Turner and Young,1969).

The Polish Lowland Sheep of the Zelazna variety was created thirty years ago by crossbreeding. Since 1956 the primitive local Merino-type Lowicka sheep was crossed with Leicester rams and F_1 progeny with Merino rams (Radomska and Skoczylas, 1974). In 1960 the flock of Zelazna sheep had about 70 ewes. In the beginning of seventies the Zelazna sheep were crossed with Polish Corriedale rams, which belong to the same Polish Lowland Sheep type, to avoid increase of inbreeding (Niznikowski et al.1984). Since then the flock was closed. Now the Zelazna flock consist of about 650-680 ewes and 28-30 rams and is the only one of this variety in Poland. The Zelazna sheep are dual purposes sheep of wool-prolific type and their performance is high in comparison with other Polish Lowland Sheep.

An analysis of inbreeding rate in the Zelazna ewes and its influence on sheep productivity was carried out.

MATERIAL AND METHODS

Data on 1522 Zelazna ewes born in 1980-1987 (3587 lambings in total) were used to carry out the analysis. The number of ewes born in succesive years is shown in Table 1. The inbreeding coefficient was estimated for all ewes, as well as its influence on their body weight at the age of 10 months and fleece weight at the age of 10 months and 2 years. Also inbreeding effects were evaluated for such reproductive traits as number of lambs born alive, the percentage of stillborn lambs and lamb losses in the first month of rearing. The statistical analysis was carried out using the least-square method (Harvey, 1987) including the effect of the year in which a ewe was born and the year of lambing.

RESULTS

The average inbreeding coefficient for all ewes is shown in Table 1. The coefficient ranged from 0% (for 41 ewes, i.e. only about 2.7% of total number) to 20% (for 3 ewes which were born in 1980 and 1981). According to their inbreeding coefficient all ewes were divided into 3 groups: ⩽2%, (2%;5%> and >5%. The number of sheep which belong to low inbreeding group has decreased in succesive years. At the same time the medium inbreeding group has increased in number while the highest has shown only slight changes.

The inbreeding of ewes had a significant negative effect on their body weight and fleece weight at the age of 10 month (Table 2). However, the estimated regression coefficient was low. The decrease of fleece weight in the second yield and ewe prolificacy was observed in the group with the highest inbreeding level,but this tendency was not statistically significant.

The increase of the number of stillborn lambs and lamb losses during the first month of their life was found in the group of ewes with inbreeding over 5%. The influence of the year of lambing is shown in Fig.1. It should be mentioned that most stillborn lambs were born in the years 1987-1989 and a lot of them showed various bone abnormalities, such as lack of cranium, lack of spine and unshaped limbs.

Table 1. Inbreeding of ewes depending on the year of birth.

Year of birth	Number of ewes	Inbreeding coefficient ± SE [%]		Percentage of ewes in inbreeding classes ⩽2%	(2 ;5>	>5%
1980	182	3.14	.23	49.5	30.2	20.3
1981	188	3.89	.28	41.0	29.2	29.8
1982	188	3.51	.26	34.6	42.0	23.4
1983	189	3.35	.24	33.4	46.0	20.6
1984	199	3.95	.28	24.6	48.2	27.2
1985	212	4.00	.27	21.7	50.9	27.4
1986	184	3.96	.29	18.5	53.8	27.7
1987	180	3.84	.29	21.7	56.1	22.2
Total	1522	3.71	.09	30.4	44.7	24.9

Table 2. The effect of inbreeding on productive and reproductive traits

Trait*	$\bar{x}$ ± sd	Inbreeding depression in group with different inbreeding level ⩽2%	(2%;5%>	>5%	re-gres-sion
1.	57.42 ± 5.67	.933	.024	.957	-.231**
2.	6.21 ± .91	.094	.024	-.117	-.016*
3.	7.92 ± 1.29	.106	-.009	-.097	ns
4.	1.59 ± .59	-.006	.021	-.015	ns
5.	3.74 ± 19.18	-.124	-.492	.616	ns
6.	2.88 ± 11.68	.075	-.134	.059	ns

* 1. Body weight at the age of 10 months
2 ,3. Fleece weight at the age of :10 months, 2 years
4. Litter size
5. Percentage of lamb losses in the first month of rearing
6. Percentage of stillborn lambs

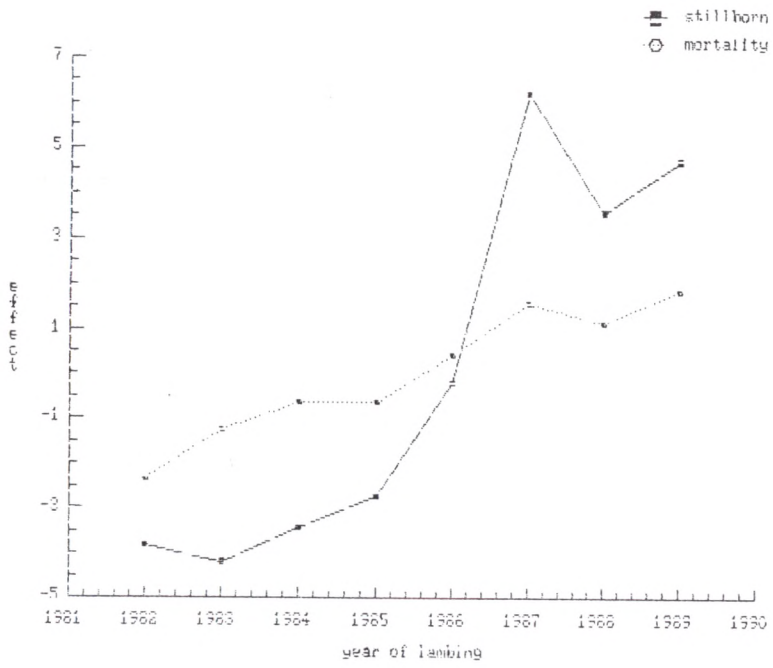

Figure 1. The influence of lambing year on the percentage of stillborn lambs and lamb losses (mortality) in the first month of rearing.

DISCUSSION

The average inbreeding coefficient of ewes is relatively low, although the breeding has been carried out in a closed flock since 1970. The increase of inbreeding per generation is lower then in the case of random matings and this is the result of a careful programme to avoid inbreeding. At the same time the flock performance as regards all selected traits has increased. The ewes born in succesive years showed a higher body and fleece weight in comparison with their older flock mates. A similar adventage of younger ewes was observed in reproductive traits. The observed negative influence of inbreeding on body weight and wool yield was found also in other sheep breeds. Liebenberg and John (1973) noticed that the increase of inbreeding by 1% resulted in a decrease of 0.086% in wool yield and 0.58% in body weight of Merino sheep, whereas the inbreeding of Hampshire sheep resulted in the lower body weight before tupping by about 0.27 kg (Lamberson and Thomas,1982). Similarly to the Zelazna flock, inbreeding did not significantly influence ewe prolificacy in Hampshire (Lamberson and Thomas,1982), German Merino (Liebenberg and John,1973) and Polish Merino (Meina et al.,1986)sheep.

The observed increase of stillborn lambs and lamb losses had different intensity according to the years of lambing and it could be a consequence of the Tchernobyl disaster in April 1986 when sheep were pastured from spring till the matting in autumn. This problem needs to be analysed in detail.

The obtained results suggest that in the closed flock of Zelazna sheep the inbreeding has not increased in a way to cause any serious depression. Although regression coefficient for body weight and fleece weight at the age of 10 months were significant ($P \leq 0.01$ and $P \leq 0.05$, respectively) their values were very low. This is undoubtedly the consequence of a proper selection of breeding animals.

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