EFFECT OF INBREEDING ON DIFFERENT PERFORMANCE TRAITS OF HISSARDALE SHEEP IN PAKISTAN

P. Akhtar, M.S. Khan, G. Mohiuddin and M. Abdullah
Faculty of Animal Husbandry, University of Agriculture, Faisalabad.-38040, Pakistan

ABSTRACT

Pedigree and data on 5252 birth records of 1179 Hissardale sheep during 1978-95 were utilized to evaluate the effect of inbreeding on various performance traits. Pedigree analysis revealed that there was a continuous upward trend in the average level of inbreeding in the flock. The coefficient of inbreeding among the 881 inbred animals averaged 6.91 percent, the highest level being 31.25 percent. The average value was 1.16 percent for all the animals. The total number of sires used was 159, which were 0.59 percent inbred on the average with the highest value being 12.5 percent. One of the main reasons for this low level of inbreeding in the flock was incompleteness of pedigrees especially for animals born in the earlier years of the period under study. Among the growth traits studied, birth weight, weaning weight and weights at other ages (60, 90, 180, 270 and 365 days) increased with increase in level of inbreeding but statistically this increase was not different from zero. The two growth traits, pre- and post-weaning growth rates did decrease with increase in inbreeding but again the decrease did not reach a significant level of 5%. Among the ewe traits, there was a decline in age and weight at first service as well as age and weight at first lambing with increase in the level of inbreeding. The number of services per conception also increased with rise in inbreeding level yet, the effect was not significant statistically. The effect of inbreeding on total fleece weight was also positive but non-significant.

Keywords: Hissardale sheep, inbreeding, performance traits

INTRODUCTION

Hissardale is a fine wool breed developed at Hissar, British India during 1930 by crossing Merino with a local carpet wool sheep known as Bikaneri. Hissardale claims 7/8 Merino inheritance (Ishaq, 1964). On independence, a flock of about 80 Hissardale sheep was received by Pakistan as its share. Since then the animals have been kept at various Livestock Experiment Stations. Currently the flock is being maintained at Livestock Experiment Station, Jahangirabad, district Khanewal, Pakistan. This breed due to its fine wool characteristics has the potential to cater the requirements of fine wool for the manufacture of apparel cloth by the woolen mills. In view of the future prospects of Hissardale sheep for the production of fine wool in Pakistan, intensification of research and development efforts for this breed are badly needed.

Inbreeding is a mating system in which offsprings are produced by parents more closely related than average of population from which they come. Inbreeding accompanied with selection may be used for the improvement of farm animals. However, past experience has shown that inbreeding is usually associated with the appearance of genetic defects and general over all decline in vigour and performance.

The decline in vigour which accompanies inbreeding is due to uncovering of detrimental recessive genes through increased homozygosity. The reduction in the mean due to inbreeding is proportional to the level of dominance in the trait (Kempthorne, 1957). A reduction in birth weight, weaning weight and wool yield has been reported by many workers (Akhtar, 1985; Khan *et al.*, 1995).

As the flock of Hissardale had been closed for outside breeding for the last many years, the level of inbreeding and its possible effects on various performance traits need to be evaluated. The present study was thus planned to estimate the intensity of inbreeding in the flock and measure its effects on the performance traits. It is envisaged that the study would be help in the formulation of future breeding plans for genetic improvement of the flock.

MATERIALS AND METHODS

Pedigree and performance data on Hissardale sheep, maintained at Livestock Experiment Station, Jahangirabad, district Khanewal, collected during 1978-1995 were used in the present investigation. The following information was collected: Individual's identity, Birth weight, Sire, Body weights at different

ages, (60,90,120,180,270 and 365 days), Dam, Date of weaning, Date of birth,Weight at breeding, Date of lambing, Weight at lambing, Sex of the lamb, Greasy fleece weight (Autumn and Spring combined) and Type of birth.

Pedigree records of all sheep were traced back to the base population to estimate coefficient of inbreeding by the Wright's Method of variance co-variance chart (Wright, 1922) using DFREML set of programmes (Meyer, 1991). The effect of inbreeding on birth weight and body weights at other ages (60, 90, 120, 180, 270 and 365 days), pre-weaning gain, post weaning gain, age at service, weight at service, age at lambing, weight at lambing, services per conception and fleece weight was studied using intrasire regression.

RESULTS AND DISCUSSION

Analysis of pedigree records of 5252 animals having identification for the extent of inbreeding revealed that 881 (16.77 percent) animals were inbred with an average inbreeding of 6.91 percent and the highest level being 31.25 percent. The average value was 1.16 percent for all the animals. The number of sires used was 159, which were 0.59 percent inbred on the average with the highest value being 12.5 percent. Most frequent value of the coefficient of inbreeding for this category of animals was zero. One of the main reason for low level of inbreeding in the flock was incompleteness of pedigrees especially for animals born in the earlier years of the period under study. About 10 percent of the animals did not have sire identification while number of animals for which both sire and dam identification was missing were 42.

The trend of inbreeding during 18 years' span has been presented in Figure No. 1. The dependent variable was the inbreeding coefficient while year of birth was the only fixed effect along with the error term. Except for the base animals (the first three years), where inbreeding was zero due to the non-availability of pedigree information, there was a continuous upward trend in the average level of inbreeding in the flock. Although, the rate of change among the consecutive years was not the same but over a span of few years, it was not different.

The level of inbreeding in the inbred population reported in other studies on sheep in Pakistan have varied widely. The coefficient of inbreeding in 164 inbred ewes averaged 10.69±0.65 percent with a range of 0.78 to 35.59 percent in the study of Akhtar (1985) on Awassi sheep. Effect of inbreeding on productive traits was studied in this study and animals were raised at Livestock Production Research Institute Bahadurnagar, Okara. Pedigree records of 392 Awassi ewes, the progeny of 25 rams were utilized in the study. Ali (1990) later studied the effect of inbreeding on various reproductive traits in the same flock. The coefficient of inbreeding ranged from 0.78 to 39.06 percent with an average of 12.18 percent. Khan *et al.* (1995) on the other hand, reported lower average value (8.75±0.25percent) for Rambouillet sheep at Livestock Experiment Station Jaba. Data on 647 Rambouillet sheep were used in the study. The coefficients varied widely with a range of 0.39-37.27 percent.

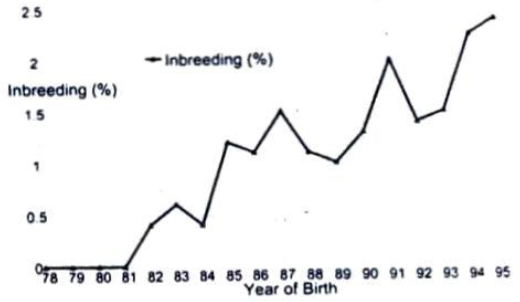

Fig. 1; Trend in coefficient inbreeding

The extent of inbreeding in sheep elsewhere have extensively been reported. Average level of inbreeding varied from 1.8 percent for Merino (Lax and Brown, 1967) to 30.4 percent for Rambouillet (Ercanbrack and Knight, 1981). The extent was likely to vary depending on the purpose for which sheep were raised and the system of breeding adopted. If the objective was the production of inbred lines, level of inbreeding would be very high as compared to the level of inbreeding when purpose was not an increase in inbreeding, rather, inbreeding was due to unplanned matings as was the case in the present stock. The incompleteness of pedigrees would be another important issue as if the number of years involved in the study were few, the proportion of base animals (non-inbred) would be higher. This may be evident from the previously mentioned two studies (Akhtar, 1985; Ali, 1990) where flock under investigation was the same but when number of years were more and pedigrees were comparatively complete (Ali, 1990), the level of inbreeding was higher.

Effect of inbreeding on various growth and reproductive traits has been presented in Table 1 and Table 2. It was evident that the level of inbreeding did not affect any of these traits significantly. Among the growth traits studied, the birth weight, weaning weight and weights at other ages (60, 90, 180, 270, and 365 days) increased with increase in the level of inbreeding but statistically this increase was not different from zero. The two growth traits studied, pre- and post-weaning growth rates did decrease with increase in inbreeding but again, the decrease did not reach a significance level of 5%.

Table 1: Effect of Inbreeding on Ewes' Traits in Hissardale Sheep.

Trait	Inbreeding Effect β*
Age at service (days)	-0.5310
Weight at service (kg)	-0.0189
Age at lambing (days)	-0.5910
Weight at lambing (kg)	-0.0245
Services per conception (number)	0.0037
Autumn fleece weight (kg)	-0.0002
Spring fleece weight (kg)	0.0015
Total fleece weight (kg)	0.0013

*Change in the trait due to 1 percent change in inbreeding

Table 2.: Effect of Inbreeding on Growth Traits.

Trait	Inbreeding Effect β*
Birth Weight (kg)	0.0009
Weight at 60 days (kg)	0.0146
Weight at 90 days (kg)	0.0022
Weaning Weight (kg)	0.0213
Weight at 180 days (kg)	0.0142
Weight at 270 days (kg)	0.0203
Weight at 1 Year (kg)	0.0353
Pre-weaning Gain (g)	-0.0001
Post-weaning Gain (g)	-0.0001

*Change in the trait due to 1 percent change in inbreeding

Among the ewe traits, there was a decline in age and weight at service as well as age and weight at lambing with increase in the level of inbreeding. Number of services per conception also increased with the rise in inbreeding level yet, effect was not statistically significant. The non-significant effect of inbreeding on growth traits like birth and weaning weight was in line with the findings of Akhtar (1985) on Awassi sheep. The decline in the two traits reported was statistically not different from zero. Non-significant effect on the ewe's trait was also in line with the findings of Ali (1990) and Akhtar (1985). Ali (1990), however, reported that the weight at first conception decreased with increase in the level of inbreeding. Decline was 467 grams ($P<0.01$) for every rise in the percent inbreeding. A non-significant rise in the number of services per conception was also in line with the findings of Ali (1990). Akhtar (1985) reported a non-significant decrease in the wool weight for Awassi sheep which was similar to the findings of the present study.

The effect of inbreeding on growth traits in sheep breeds elsewhere varied widely but generally inbreeding had a deteriorating effect on birth weight, weaning weight and post-weaning body weight (Lamberson and Thomas, 1984). On the average, an increase in 1 percent in individual inbreeding decreased the birth weight by 13 gram, weaning weight by 111 gram and post-weaning weight by 178 gm in the seven studies reviewed by Lamberson and Thomas (1984). Dam's inbreeding was reported to have an effect on birth weight but weaning weight and post-weaning body weight were little affected by the dam's inbreeding.

For the ewe traits, for each 1 percent rise in inbreeding, a decrease of 17 gm in greasy fleece weight was reported by Lamberson and Thomas (1984) after reviewing information collected from over 6000 sheep of different breeds. The medium level of inbreeding in this flock did not affect any of the performance traits. The deterioration if any was not statistically significant. The analysis was done on intra-sire basis but sire effects did not control a lot of variation, in most of the traits it could not reach statistical significance. Most of the fixed effects in the model were similar to those presented elsewhere (Akhtar,1996). Second degree polynomial was also tried but as the effect for both the first degree and the second degree were not statistically important, results from the model having inbreeding as a single degree covariable are presented. The level of inbreeding was comparatively lower than the two other flocks of sheep studied under Pakistani conditions. Although, the earlier studies reported that performance traits were deteriorated with rise in the level of inbreeding, the level of inbreeding in the flock under investigation was lower and proportion of variation controlled by this factor was not significantly important. The continuous rise in the level of inbreeding over the years however, warns that matings

in the future should be more planned especially among very close relatives.

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