

## EFFECT OF INBREEDING ON PERFORMANCE TRAITS OF AWASSI SHEEP

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### ABSTRACT

Pedigree records of 392 Awassi ewes, the progeny of 25 rams were used to study the effect of inbreeding on performance traits. The coefficients of inbreeding in 164 inbred ewes averaged  $10.69 \pm 0.65\%$  with a range from 0.78 to 35.59%. Birth weight, adjusted 120 days weaning weight and wool yield per annum averaged  $4.00 \pm 0.05$ ,  $27.39 \pm 0.33$  and  $2.61 \pm 0.03$  kg, respectively in the inbred ewes. The regression analyses revealed that the three traits were not significantly affected by the level of inbreeding. The regressions of birth weight, weaning weight and wool yield on inbreeding were  $-0.002 \pm 0.009$ ,  $-0.082 \pm 0.052$  and  $-0.008 \pm 0.005$  kg, respectively. Prolificacy averaged  $1.12 \pm 0.02$  lambs per ewe lambing and was not significantly affected by the level of inbreeding. Regression of prolificacy on inbreeding was  $-0.006 \pm 0.005$  lambs.

### INTRODUCTION

Pakistan pastures 26.6 million sheep providing about 22% of meat and 53.2 thousand tonnes of coarse wool annually. Selection within indigenous breeds is being carried out for genetic improvement of sheep but this approach is capital and time intensive. The improvement in mutton and wool yield without sacrificing carpet quality can also be sought by crossing with carefully selected exotic breeds. The Awassi sheep native of Middle East, has been introduced in Pakistan on experimental basis. The analysis of data accumulated for the last twenty years could provide information about the suitability of the breed for propagation. The imported flock remained closed for outside

breeding, the logical consequence of which was the high intensity of inbreeding. The experience has shown that inbreeding is usually associated with the appearance of genetic defects and general overall decline in vigour and performance. Thus, while analysing various factors influencing the productivity in Awassi breed in Pakistan, the probable inbreeding effects should also be kept in view.

A study was thus undertaken to estimate the intensity of inbreeding in a closed flock of Awassi sheep and also to estimate the possible effects of inbreeding on body weight, wool yield and prolificacy.

### MATERIALS AND METHODS

*Source of Data:* Pedigree and production records of 392 Awassi ewes, the progeny of 25 rams maintained at Livestock Production Research Institute, Bahadurnagar (Okara) during 1965-84 were used. The foundation flock of 50 ewes and 10 rams was imported from Lebanon in 1965 for use as a nucleus for cross breeding with local sheep. The flock remained closed for outside breeding.

*Statistical Analysis:* Pedigree of all the sheep was traced back to estimate the coefficient of inbreeding by the Wright's method of path coefficient (Wright, 1922) and variance covariance charts. The effect of inbreeding on birth weight, weaning weight, wool yield and prolificacy was studied. The twinning was 15.2% in this flock. The birth-type effects were minimized by multiplying twin records with factor 1.1842 for birth weights and with factor 1.1680 for weaning weights. The weaning weights were adjusted on 120-day basis by using correction factors developed for the purpose. The birth weight and adjusted weaning weight were deviated from the respective yearly means to remove year effects from the data.

The shearing was done once a year during 1965-73, whereafter, it was done twice a year. The data on twice a year shearing was multiplied with factor 0.7873 to convert wool yield on once a year shearing basis. The corrected records were used to estimate the repeatability of wool yield. Expected Real Producing Ability for wool yield of each ewe was worked out according to the formula by Lush (1945). The prolificacy assumed as the number of alive lambs produced per ewe per lambing was also worked out for each ewe.

Intrasire regression of a particular trait on inbreeding was calculated to by-pass most of the effects of genetic and environmental time trends which could

confound the inbreeding effects. Standard errors of intrasire regressions were calculated by the formula described by Becker (1984). The analysis of variance was carried out to test the  $H_0 : B = 0$ .

## RESULTS AND DISCUSSION

Pedigree analysis revealed that out of 392 ewes born at the farm, 164 (42 %) were inbred. Inbreeding coefficients ranged from 0.78 to 35.59 % with mean of  $10.69 \pm 0.65$  %. The average birth weight was  $4.00 \pm 0.05$  kg, and the weaning weight adjusted to 120 days averaged  $27.39 \pm 0.33$  kg. The average wool yield was  $2.61 \pm 0.03$  kg per annum. Mean prolificacy expressed as the number of lambs per ewe lambing was  $1.12 \pm 0.20$ .

### Effect of Inbreeding on Various Traits

*Birth weight:* The intrasire regression of birth weight on inbreeding was  $-0.002 \pm 0.009$  kg (Table 1). Analysis of variance showed that the regression in birth weight due to inbreeding was non-significant (Table 2). Inbreeding contributed 1.85 % of the total variation in birth weight. The results of the present study are in agreement with those reported by Ragab and Asker (1954) and Kasenoy *et al.* (1971), who reported non-significant decline in birth weight due to inbreeding. It was also reported by many workers that the inbred lambs were lesser in birth weight than outbreds (Aboul-Naga and Galal, 1972; Penkov and Lazarov, 1980).

Table 1. *Effect of inbreeding on performance traits by intrasire regression analysis*

| Trait                                  | No. of observations | Average inbreeding (%) | Intercept ( $b_0$ ) | Regression coefficient ( $b_1$ ) |
|----------------------------------------|---------------------|------------------------|---------------------|----------------------------------|
| Birth weight (kg)                      | 157                 | $10.80 \pm 0.58$       | 4.02                | $-0.002 \pm 0.009$               |
| Weaning weight (kg)                    | 157                 | $10.80 \pm 0.58$       | 28.27               | $-0.082 \pm 0.052$               |
| Wool yield (kg)                        | 145                 | $10.55 \pm 0.60$       | 2.70                | $-0.008 \pm 0.005$               |
| Prolificacy (No. of lambs/ewe/lambing) | 108                 | $9.96 \pm 0.68$        | 1.19                | $-0.008 \pm 0.005$               |

A significant decline in birth weight due to increase in inbreeding was reported by Lax and Brown (1968) and Wiener and Wooliams (1982). Lax and Brown (1968) reported a decrease of 0.015 kg birth weight for each one percent

increase in inbreeding. The findings of Lamberson *et al.* (1982) were contrary to the present results as they reported a regression of 0.022 kg in birth weight on each one percent of inbreeding among Hampshire sheep.

Table 2. *Analysis of variance for regression of some performance traits due to inbreeding*

| Trait          | Source of variation | Degree of freedom | Mean squares | F-ratio |
|----------------|---------------------|-------------------|--------------|---------|
| Birth weight   | Regression          | 1                 | 0.01         | NS      |
|                | Residual            | 155               | 0.40         | 0.02    |
| Weaning weight | Regression          | 1                 | 30.64        | NS      |
|                | Residual            | 155               | 17.76        | 1.72    |
| Wool yield     | Regression          | 1                 | 0.27         | NS      |
|                | Residual            | 143               | 0.15         | 1.83    |
| Prolificacy    | Regression          | 1                 | 0.09         | NS      |
|                | Residual            | 106               | 0.06         | 1.54    |

NS = Non-significant.

*Weaning weight:* The regression of weaning weight on inbreeding was  $-0.082 \pm 0.052$  kg (Table 1). The regression in weaning weight was found to be non-significant (Table 2). The inbreeding accounted for 1.96 % of total variation in the weaning weight. The findings of the present study for the effect of inbreeding on weaning weight were quite in agreement with those reported by Ragab and Asker (1954) and Lamberson *et al.* (1982). A non-significant decrease in weaning weight due to inbreeding was reported by these workers. A number of other workers reported a significant decrease in weight due to inbreeding (Hazel and Terrill, 1946; Wiener and Wooliams, 1982). The outbred lambs were also found to be heavier than inbred lambs at weaning (Aboul-Naga and Galal, 1972).

*Wool yield:* The regression of wool yield on inbreeding was  $-0.008 \pm 0.005$  kg (Table 1). The analysis of variance revealed that regression of wool yield due to inbreeding was non significant (Table 2). The variation in wool yield due to inbreeding was 2.48%. A non-significant decrease in wool yield due to increasing level of inbreeding as obtained in the present study was in confirmation

with the findings of Lamberson *et al.* (1982). It was further reported by Hazel and Terrill (1946) and Lax and Brown (1987) that wool yield was significantly depressed as a result of increase in the intensity of inbreeding. The comparison of outbred and inbred sheep also pointed out that wool yield was lesser in the inbred group of sheep than outbreds (Aboul-Naga and Galal, 1972; Penkov and Lazarov, 1980; Ercanbrack and Knight, 1981).

*Prolificacy:* The intrasire regression of prolificacy on inbreeding was  $-0.006 \pm 0.005$  which indicated that the prolificacy decreased by 0.60% for each one percent increase in inbreeding (Table 1). The analysis of variance showed that this decline was non-significant (Table 2). The contribution of inbreeding to the total variation in prolificacy was 1.76%. The results about the prolificacy as obtained in the present investigation were in line with the findings of Lamberson *et al.* (1982) and Lamberson and Thomas (1984) who observed that prolificacy was little affected by increase in inbreeding.

The extent of variation due to inbreeding in the performance traits of the Awassi shdep of this flock are not alarming since the effects of inbreeding were non-significant. However, an overall reduction in growth, output of wool and lamba was obvious and a further increase in the inbreeding intensity could lead to drastic deterioration in this flock. Moreover, selection cannot overcome the negative effects of inbreeding when both are practised simultaneously. It is, therefore, suggested that a fresh infusion of the germplasm may be made in this flock to avoid further deterioration.

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