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ENVIRONMENTAL FACTORS AFFECTING WEANING WEIGHT IN LOHI SHEEP

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ABSTRACT

Data on 3984 lambing records of 1285 Lohi ewes kept at the Livestock Production Research Institute, Bahadurnagar, Okara for he period 1960-90 were analyzed by using Harvey's Mixed Model Least Squares and Maximum Likelihood Computer Program. The purpose was to estimate the magnitude of various environmental sources of variation influencing weaning weight in this breed of sheep. The least squares mean for 120-day adjusted weaning weight was 23.09 ± 0.13 kg. The trait was significantly ($P<0.01$) influenced by the year and season of birth, type of birth and the sex of the lamb born.

Key words: Lohi sheep, weaning weight, environmental factors

INTRODUCTION

Pakistan supports over 64 million small ruminants, which are the major source of livelihood for over a million farmers. These animals provide 47 per cent of the total meat produced in the country (GOP, 2002). The mutton is the preferred meat in this country and priced much higher than the beef. In addition, the small ruminants provide wool, hair and skins which are used as raw material in carpet and leather industries. Annual production of wool is estimated to be 39.5 thousand tons, out of which over seven thousand tons of raw carpet wool worth Rs. 100 million is exported (GOP, 2002). The remaining wool is used in thriving the local carpet manufacturing industry, which provides jobs for thousands of families in remote areas of the country. The export of carpet earns foreign exchange worth more than 15 billion rupees per year (GOP, 2002).

The Lohi is the biggest and most productive sheep breed in the country. It comprises some 40 per cent of the Punjab and 15 per cent of the national population (GOP, 1996). The Lohi breed belongs to the irrigated areas of the central Punjab but is wide-spread in other regions of the Province. There is a wide diversity in various production traits of this breed which suggests that there is a great scope for improvement of its performance. This diversity in performance could be due to several genetic and environmental influences.

Any breed development programme would base on the exploitation of genetic variation. The variation in body weight, productive and reproductive parameters and wool yield can be skillfully exploited if the extent of genetic and environmental causes of variation in these traits are precisely known. The observed performance of each animal for each trait is the result of the heredity that it receives from both parents and the environment in which it is raised. Even when an attempt is made to provide a uniform environment, there are still accidental and unknown environmental differences between animals. Such random environmental factors thereby cause differences in the expression of economically important traits. Performance records of animals should be adjusted to reduce or discount known environmental differences between animals so that genetic differences among animals can be recognized and used for effective breeding plan for their improvement. Adjustment should be made for environmental and physiological sources of variation such as age, sex, birth type, years, seasons and such other environmental variables that can be assessed or evaluated. Genetic differences between animals do exist but large environmental differences make the evaluation of such genetic differences extremely difficult.

A study was thus planned on Lohi sheep to measure the effect of known environmental factors affecting weaning weight which laid to obscure the genetic differences among animals.

MATERIALS AND METHODS

The data on 3984 lambs born from 1285 Lohi ewes sired by 90 rams kept at the Livestock Production Research Institute, Bahadurnagar, Okara over a 30 years period from 1960 to 1990 were utilized to estimate the effect of environmental factors affecting weaning weight. The factors studied included year and season of birth, type of birth and sex of lamb. The regression analysis revealed that weaning age (X) had significant effect on weaning weight (Y). Hence, prediction equation $Y = a + bX$ was derived and values of weaning weight for different weaning ages were calculated. These adjusted records were subjected to analysis of variance for the estimation of the magnitude of the environmental factors. The mathematical description for the model assumed to influence weaning weight was.

$$Y_{ijklm} = \mu + P_i + S_j + T_k + X_l + (TX)_{kl} + \varepsilon_{ijklm}$$

Where,

- Y_{ijklm} = weaning weight of m^{th} lamb of l^{th} sex, k^{th} birth type born during j^{th} season in i^{th} year
- μ = overall population mean
- P_i = effect of i^{th} year (i = 1 to 30)
- S_j = effect of j^{th} season (j = spring, autumn)
- T_k = effect of k^{th} type of birth (single, multiple)
- X_l = effect of l^{th} sex of lamb born (male, female)
- $(TX)_{kl}$ = effect of interaction between k^{th} birth type and l^{th} sex of the lamb
- ε_{ijklm} = random error associated with m^{th} lamb of l^{th} sex, k^{th} birth type born during j^{th} season of i^{th} year. It was further assumed that ε_{ijklm} was normally and independently distributed with mean zero and variance σ^2

The weaning weight data represented unequal disproportionate subclass frequencies and were, thus, analysed by using Harvey's Mixed Model Least Squares and Maximum Likelihood computer programme (Harvey, 1990).

RESULTS AND DISCUSSION

Analysis of variance for regression indicated that weaning weight of Lohi lambs was significantly affected by the age at weaning. The weaning weight increased by 0.085 kg for each day increase in weaning age. The prediction equation derived for estimating weaning weight (Yi) for any age at weaning (Xi) was:

$$Y_i = 14.203 + 0.085\, X_i$$

The adjusted weaning weight records of 3984 lambs were analysed for testing the magnitude of variation in weaning weight due to year and season of birth, birth type and sex of lamb born. Mean weaning weights in each category of factors influencing the trait are shown in Table 1 and the analysis of variance for the significance of these factors influencing this trait is given in Table 2. The weaning weight varied significantly ($P < 0.01$) among the years and seasons of lambing. There was no specific trend in the weaning weight in different years. Mean weaning weight was the highest in the year 1967 (27.09 ± 0.13 kg), while it was the lowest in 1979 (20.13 ± 0.12 kg). Mean weaning weight was higher among lambs born during spring than those born in autumn season. The weaning weight was significantly affected by the birth type and the sex of the lamb. Single born lambs were heavier than lambs born as twins or triplets. The male lambs were heavier at weaning than female lambs, average being 24.32 ± 0.15 kg for male and 21.86 ± 0.16 kg for female lambs (Table 1).

The yearly and seasonal differences in weaning weight reflected variation in feeding and managemental practices. The influences of year and season also fit natural environmental conditions like rainfall which results in lowering of environmental temperature and improvement of the feed situation. The higher weaning weight of spring born lambs may be due to availability of lush green fodder during the later part of dams' pregnancy and early part of lambs' life as compared to that available to autumn born lambs. A number of workers also reported that the weaning weight of lambs differed significantly due to year and season of birth (Charyuiu and Muniraihnam, 1984; Singh *et al.* 1987; Naikare and Jagtap, 1988; Cho *et al.* 1989; Tizikara and Chiboka 1989; Wojtowskt *et al.* 1990). However, some workers reported that there were no significant differences in weaning weight of lambs due to year and season (Kassab and Karam, 1961; Botswana, 1986).

The analysis of data also revealed that differences in weaning weight due to birth type and sex of lamb were significant. This may be due to the reason that single born lambs had better opportunities in the mother's wombs than the twins or triplets and were hence heavy at birth. The male lambs generally stay slightly longer in mother's womb than female and hence heavier at birth. These results were also confirmed by Charyuiu and Muniraihnam (1984), Singh *et at.* (1987), Naikare and Jagtap (1988), Cho *et at.* (1989), Tizikara and Chiboka (1989) and Wojtowskt *et at.* (1990), who reported that weaning weight of lambs was significantly affected by sex and birth type of lamb. However, Kassab and Karam (1961) reported that sex did not affect weaning weight in Barki lambs. Maui and Rodricks (1987) reported that though males were heavier than females at weaning but the sex differences were not significant in Merino x Niligiri crossbred lambs.

The results of the present study revealed that environmental factors cause differences in the expression of economically important trait like weaning

Table 1: Least squares means (LSM) and standard error (SE) of weaning weight of lambs

Classification	No. of records	LSM ± SE (kg)	Classification	No. of records	LSM ± SE (kg)
Overall	3984	23.09 ± 0.13	1981	194	21.60 ± 0.11
Years			1982	207	26.13 ± 0.10
1960	23	20.37 ± 0.10	1983	218	25.78 ± 0.11
1961	25	23.50 ± 0.17	1984	203	23.65 ± 0.18
1962	33	21.94 ± 0.15	1985	220	24.18 ± 0.13
1963	40	22.63 ± 0.12	1986	128	20.93 ± 0.14
1964	54	21.91 ± 0.16	1987	60	23.47 ± 0.14
1965	89	23.36 ± 0.15	1988	51	24.97 ± 0.13
1966	117	25.24 ± 0.16	1989	36	23.13 ± 0.08
1967	151	27.09 ± 0.13	**Seasons**		
1968	169	24.19 ± 0.11			
1969	178	26.10 ± 0.14	Spring	3149	24.94 ± 0.10
1970	174	26.27 ± 0.11	Autumn	835	21.24 ± 0.24
1971	160	24.35 ± 0.13			
1972	174	26.48 ± 0.12	**Birth type**		
1973	136	26.38 ± 0.12			
1974	1388	25.07 ± 0.10	Single	2101	24.42 ± 0.15
1975	152	26.88 ± 0.18	Multiple	1883	21.76 ± 0.17
1976	140	24.35 ± 0.13			
1977	163	20.41 ± 0.10	**Sex of lamb**		
1978	188	20.55 ± 0.15			
1979	191	20.13 ± 0.12	Male	2053	24.32 ± 0.15
1980	172	22.91 ± 0.16	Female	1931	21.86 ± 0.16

Table 2: Least-squares analysis of variance for weaning weight

Source of variation	Df	Mean squares	F values
Years	29	283.79	13.48**
Seasons	1	5825.34	276.87**
Birth type	1	5012.25	238.22**
Sex of lamb	1	5586.88	265.54**
Type x sex	1	44.27	2.10^{NS}
Remainder	3946	21.04	

** = Significant (P< 0.01) NS = Non-significant

weight. Performance records of animals should be adjusted to reduce or discount known environmental differences between animals so that genetic differences among animals can be recognized and used for effective breeding plan for their improvement.

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