Iran. J. Agric. Res. Vol. 6, No. 1, pp. 41–47. 0363–1307/78/0601–0041$02.00/0.

CROSSBREEDING OF IRANIAN FAT-TAILED SHEEP – III. THE RELATIONSHIPS OF PRE- AND POST-WEANING GROWTH PERFORMANCE OF LAMBS[1]

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Abstract – The correlation and regression coefficients between some pre-weaning (birth weight, weaning weight and pre-weaning average daily gain) and feedlot traits were estimated using 155 records of Karakul, Mehraban and Naeini ram lambs and all their reciprocal crosses. The lambs were weaned at 75±10 days of age and were fattened in a 120-day drylot test. Feedlot measurements were taken at 20-day intervals.

(1) Birth weight, weaning weight, total gain from birth to weaning and gain in the first 20 days in feedlot were positively and significantly associated with body weight at different 20-day intervals in feedlot, as well as with final weight.
(2) Amongst the pre-weaning traits studied, daily gain from birth to weaning had the highest correlation with total feedlot daily gain ($r = 0.36, p < 0.01$).
(3) Amongst the different feedlot traits studied, gain in the second 20-day interval had the highest association with the average feedlot daily gain ($r = 0.60, p < 0.01$).
(4) The pre-weaning traits, post-weaning body weights and gains in the first and second 20-day intervals in drylot did not have significant associations with the total feed conversion.
(5) Total gain in different 40-day intervals and total feedlot gain were negatively associated with the corresponding feed conversion (kg feed/kg gain), indicating that rate and efficiency of gain can be improved simultaneously.

INTRODUCTION

In the earlier publications, the pre- and post-weaning growth performance of the three Iranian breeds of sheep; Karakul, Mehraban and Naeini, and their reciprocal crosses were reported [3, 6]. Some genetic parameters of growth traits were also estimated [4]. Information on the relationships between pre- and post-weaning traits and the relationships between various feedlot traits are helpful in breeding plans.

Studies concerning the relationships between production traits in Iranian breeds of sheep are at best very limited and in most cases non-existent. In this study, the phenotypic relationships between some pre- and post-weaning traits and also the relationships between some feedlot traits are estimated.

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MATERIALS AND METHODS

An experiment comparing three fat-tailed Iranian sheep breeds (Karakul, Mehraban and Naeini) and their reciprocal crosses was conducted in 1972. Details of the experimental procedure, general information on the breeds and management of the ewe flock were presented earlier [3, 6]. In this study, the relationships between pre-weaning traits and feedlot performance and also the relationships between some feedlot traits were studied.

Records of 155 ram lambs of Karakul, Mehraban and Naeini breeds and all their reciprocal crosses were used. The lambs were weaned at 75±10 days of age and were compared in a 120-day feedlot test. The fattening ration consisted of 45.1% hay (alfalfa and wheat straw) and 54.9% concentrate with mineral supplements (barley, dried sugarbeet pulp with molasses, ammonium phosphate and salt), which were ground, mixed and fed *ad libitum*. The ration provided 8.9% crude protein. Body weight and feed consumption were measured in 20-day intervals. The first 20 days in the feedlot was considered as the adjustment period. Since 120 days in the feedlot was found to be too long [6], total feedlot daily gain and total feed conversion were calculated from the records obtained between 20–100 days in the feedlot.

The least-squares method of fitting constants was used to analyze the data [5]. The constants were fitted for breeds of sire, dam and their interaction, age of dam and regression of different feedlot traits on pre-weaning lamb performance and also on some other feedlot traits. Gross correlation coefficients were also estimated between different characteristics.

RESULTS AND DISCUSSION

Body weight in feedlot

Covariance relationships of body weight at different 20-day intervals in the feedlot with some pre-weaning and feedlot traits are shown in Table 1. Gross correlation coefficients between birth weight and weight at subsequent ages decreased steadily from 0.43 (at weaning weight) to 0.35 (at 120 days weight in feedlot) ($p < 0.01$). The regression coefficients of body weight in successive 20-day periods in the feedlot on birth weight increased from 2.23 kg to 2.99 kg which also were highly significant. The regression and correlation coefficients did not correspond in all cases because the data were adjusted for breed of sire, breed of dam, breed of sire X breed of dam interaction and age of dam in estimating the regression coefficients, whereas no adjustment was made in estimating correlation coefficients. The estimated correlation coefficient between birth weight and weaning weight is not far from corresponding estimates of 0.49 obtained by Thrift *et al.* [8] and 0.54 by Nichols and Whiteman [7], but is higher than 0.29 in Rambouillet and 0.38 in Romnelet which were estimated by Vesely *et al.* [9]. The estimated correlation coefficient between birth weight and market weight is in close agreement with the estimation made by Vesely *et al.* [9] which was 0.32.

Weaning weight was found to be significantly associated with weight at different 20-day intervals in the feedlot. Gross correlation coefficients between weaning weight and weight at different feedlot periods decreased steadily from 0.94 to 0.79, and the

Table 1. Covariance relationships of body weights at different feedlot periods with some pre-weaning and some feedlot traits

Independent variable		Weight at different intervals in feedlot (days)						
		Weaning	20	40	60	80	100	120
Birth weight (kg)	b	2.08†	2.23†	2.44†	2.48†	2.67†	2.46†	2.99†
	r	0.43†	0.42†	0.41†	0.38†	0.38†	0.36†	0.35†
Weaning weight (kg)	b	–	0.93†	0.98†	1.02†	1.01†	0.99†	1.04†
	r	–	0.94†	0.92†	0.88†	0.86†	0.81†	0.79†
Gain from birth to weaning (kg)	b	1.03†	0.95†	1.00†	1.04†	1.03†	1.01†	1.05†
	r	0.98†	0.92†	0.90	0.87†	0.84†	0.79†	0.77†
Body weight after 20 days in feedlot (kg)	b	–	–	1.00	1.10†	1.10†	1.06†	1.12†
	r	–	–	0.97	0.95†	0.91†	0.85†	0.84†
Gain in first 20 days in feedlot	r	–	0.20*	0.18*	0.21*	0.18*	0.16*	0.16*

*Significant at $p < 0.05$.

†Significant at $p < 0.01$.

b is within breed of sire, breed of dam and age of dam regression coefficient.

r is gross correlation coefficient.

regressions of corresponding weights on weaning weight were found to be between 0.93 and 1.04 kg. It may be concluded that the lambs which were lighter at weaning, remained lighter in the feedlot and their weights were not compensated for during this period. Vesely *et al.* [9] found the correlation between weaning weight and market weight to be 0.67 which is somewhat lower than the value obtained in this study. A correlation coefficient of 0.81 between weaning weight and market weight and a regression coefficient of market weight on weaning weight equal to 1.01 were reported by Botkin [2] which are in close agreement with the values obtained in this study.

The associations between kg gain from birth to weaning and body weights at different 20-day intervals in the feedlot were positive and highly significant. The coefficients were very similar to those estimated for weaning weight with corresponding weights. Therefore, weaning weight and gain from birth to weaning were essentially the same as predictors of body weight in the feedlot.

Among the measurements in the early stages in the feedlot, body weight after 20 days had special value because it was highly associated with body weight at subsequent ages. It is of considerable interest that gain during the adjustment period (first 20 days) was less associated with body weight at subsequent ages than gain from birth to weaning. The correlation coefficients between kg gain in adjustment period and body weights after different 20-day intervals in the feedlot were found to be between 0.16 and 0.21, which were about one fourth of the corresponding correlation estimates between gain from birth to weaning and body weights in the feedlot. It may be concluded that the faster growing lambs in the adjustment period were not necessarily the heavier ones.

Feedlot daily gain

Birth weight did not have a significant association with daily gain in different 20-day feedlot periods and total feedlot daily gain (Table 2). The correlation coefficients were variable, ranging from negative to positive values. Similar correlation coefficients between birth weight and average feedlot daily gain were reported by Vesely *et al.* [9] in Rambouillet (0.11) and Romnelet (0.12) breeds of sheep. Thrift *et al.* [8] found the phenotypic correlation between birth weight and total feedlot gain to be 0.24 which is somewhat higher than the values obtained in this study.

The relationships between weaning weight and average daily gain in successive 20-day intervals in the feedlot and those between pre-weaning average daily gain and daily gain in different 20-day feedlot periods were very variable. The negative association between weaning weight and daily gain in adjustment period and also the negative association between pre-weaning average daily gain and daily gain in adjustment period, indicate that generally the heavier and faster growing lambs in pre-weaning stage have a lower rate of growth in the early stages after weaning. This might be due to the fact that the faster growing lambs in the pre-weaning period may be more sensitive to the stress caused by weaning and individual feeding.

The significant positive association between weaning weight and daily gain between

Table 2. Covariance relationships of feedlot daily gain with some pre-weaning and some feedlot traits

Independent variable		Daily gain after days in feedlot						
		0–20	20–40	40–60	60–80	80–100	100–120	20–100
Birth weight (kg)	b	7.46	10.24	1.89	9.26	−10.36	26.45†	2.75
	r	0.00	0.15	−0.03	0.12	0.02	0.13	0.10
Weaning weight (kg)	b	−3.63*	2.77*	1.65	−0.20	−1.22	2.69*	0.75
	r	−0.15	0.35†	0.14	0.13	0.06	0.24†	0.26†
Daily gain from birth to weaning (g)	b	−0.22	0.28*	0.27*	−0.01	−0.01	0.22	0.13
	r	−0.08	0.40†	0.25†	0.15	0.13	0.25†	0.36†
Body weight after 20 days in feedlot (kg)	b	–	2.62*	2.64*	−0.46	−1.60	2.99*	0.80
	r	–	0.35†	0.20*	0.11	0.05	0.27†	0.27†
Body weight after 40 days in feedlot (kg)	b	–	–	2.29*	0.23	−1.34	3.06†	1.74†
	r	–	–	0.21†	1.15	0.08	0.28†	0.39†
Gain in first 20-day interval (kg)	b	–	−0.49	6.25†	−1.60	−2.47	2.19	0.42
	r	–	0.0	0.17*	−0.05	−0.04	0.09	0.02
Gain in second 20-day interval (kg)	b	–	–	0.96	8.75	−0.02	7.57	14.92†
		–	–	0.14	0.24†	0.16*	0.20*	0.60†

*Significant at $p < 0.05$.

†Significant at $p < 0.01$.

b is within breed of sire, breed of dam and age of dam regression coefficient.

r is gross correlation coefficient.

20 to 40 days in the feedlot and between pre-weaning average daily gain and feedlot daily gain between 20 to 40 days, indicate that the superior lambs are adapted to the drylot condition within the first 20 days and demonstrate their potential for rapid growth after the adjustment period. A comparable correlation coefficient between pre-weaning average daily gain and feedlot daily gain (0.41) was estimated by Nichols and Whiteman [7], but Vesely *et al.* [9] reported the correlation coefficient between these traits to be –0.13 in Rambouillet and –0.02 in Ramnelet sheep.

Weaning weight and pre-weaning average daily gain can be considered as more reliable indicators of subsequent feedlot performance than kg gain in the first 20 days in the feedlot (Table 2).

Feed conversion

The pre-weaning lamb performances were independent of post-weaning feed conversion (kg feed/kg gain). The correlation and regression coefficients ranged from small negative to negligible positive values (Table 3). The correlation coefficients between birth weight and feed conversion (0.06 in Rambouillet and 0.02 in Romnelet) estimated by Vesely *et al.* [9] were similar to the values found in this study; however those authors reported higher correlation coefficients (0.39 in Rambouillet and 0.28 in Romnelet) between weaning weight and feed conversion than the estimates found in this experiment.

The early feedlot measurements did not have an important influence on total feed conversion. Two conflicting forces are at work in relationships between body weight, gain

Table 3. Covariance relationships of feed conversion (kg feed/kg gain) at different feedlot periods with some pre-weaning and some feedlot traits

Independent variable		Feed conversion after days in feedlot			
		0–40	40–80	80–120	20–100
Birth weight (kg)	b	–0.09	0.50	–0.35	0.71
	r	–0.09	0.12	0.05	0.03
Weaning weight (kg)	b	0.24	0.20*	–0.02	0.13
	r	–0.03	0.16*	–0.02	0.01
Daily gain from birth to weaning (g)	b	0.01	0.01	0.00	0.0
	r	–0.11	0.08	–0.06	–0.03
Body weight after 20 days in feedlot	r	–0.22†	0.20*	0.01	0.04
Body weight after 40 days in feedlot	r	–0.32†	0.18*	0.0	0.0
Kg gain in first 20-day interval	r	0.55†	0.12	0.09	0.08
Kg gain in second 20-day interval	r	–0.51†	–0.03	–0.04	–0.12

*Significant at $p < 0.05$.

†Significant at $p < 0.01$.

b is within breed of sire, breed of dam and age of dam regression coefficient.

r is gross correlation coefficient.

and feed efficiency. The lambs which were larger at the start of any period had more weight to maintain in that period and, therefore, at the same feed intake, had less feed available to be used for gain than did the smaller ones. This phenomenon can be observed to some extent in Table 3. Also, in any period, lambs of the same size which gained more rapidly had lower maintenance requirements per unit of gain than did lambs gaining less rapidly. Therefore, in order for the larger lambs to be more efficient, they must also gain more rapidly, a trend that could be found by considering the relationships between gain in the second 20-day period and feed conversions (Table 3). Botkin [1] reported the correlation between initial weight and feed per unit gain to be 0.33 and 0.47 in two experiments and concluded that the larger lambs were less efficient.

The associations between feed conversion in different 40-day intervals with corresponding kg gain and also the association between total feed conversion (between 20 to 100 days in the feedlot) with total feedlot gain were all negative and highly significant (Table 4). Botkin [1] reported the correlation between the same traits to be −0.72 and Vesely *et al.* [9] estimated the correlation coefficients of −0.69 and −0.71 in Rambouillet and Romnelet sheep, respectively. The results of this study indicate that rate and efficiency of gain could be improved simultaneously.

Table 4. Correlation coefficients between feed conversion (kg feed/kg gain) at different feedlot periods with corresponding kg gain

	Feed conversion at days in feedlot			
kg gain at:	0–40	40–80	80–120	20–100
0–40	−0.75†	0.11	0.04	−0.01
40–80		−0.75†	−0.33†	−0.21†
80–120			−0.76†	−0.19*
20–100				−0.27†

*Significant at $p < 0.05$.

†Significant at $p < 0.01$.

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