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CROSSBREEDING OF IRANIAN FAT-TAILED SHEEP – II. FEEDLOT PERFORMANCE OF KARAKUL, MEHRABAN, NAEINI AND THEIR RECIPROCAL CROSSES[1]

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Abstract – Feedlot daily gains, feed conversions and final weights of 155 ram lambs of three fat-tailed Iranian breeds of sheep and their reciprocal crosses were analysed by the least-squares method.

Breeding groups (3 straightbred and 6 crossbred groups) had a significant effect on feedlot performance. Among the straightbreds, Mehraban had a significantly higher rate of growth in drylot (151.6 g) followed by Karakul and Naeini lambs. Mehraban was significantly more efficient (8.2 kg feed/kg gain) than Karakul, whereas Naeini was intermediate. Mehraban and Karakul lambs did not show a significant difference in final weight and both were significantly heavier than Naeini lambs. The performance of different crossbred groups are also discussed. Age of dam had no effect on feedlot performance.

INTRODUCTION

Although Iran has been ranked ninth among the leading sheep producing countries of the world in sheep population [6], domestic meat production cannot meet the consumer's demand. The preference of people for lamb and mutton and the low productivity of the native breeds are among the main factors for this severe shortage.

A high proportion of the sheep population is managed under migratory systems. Ewes under this system usually lamb in late winter when they are in the southern winter ranges. At the beginning of spring, the sheep are sent to the summer mountain ranges in cooler regions until the end of the summer. The lambs are mostly sold on their return from the mountain ranges. The ewes are generally milked and the lambs are usually weaned when they are about 12 weeks of age. Since the ranges are usually poor and lambs are not given supplementary feed, they are not well finished and their market weight is low.

An intensive system of sheep production has been introduced recently, but possibly due to the low productivity of the breeds, these operations have not generally been successful.

Determination of suitable and efficient breeds or breed combinations for feedlot operations may contribute to the expansion of lamb production. Research is also needed to estimate the relative importance of different factors influencing the rate and efficiency

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of gain in drylot before starting any breeding plan on the native breeds.

The purpose of this study was to evaluate the feedlot performance of three fat-tailed Iranian breeds of sheep, and to compare the performance of crossbred and straightbred lambs.

MATERIALS AND METHODS

The experiment involved one hundred and fifty-five ram lambs of three fat-tailed Iranian sheep breeds (Karakul, Mehraban and Naeini), and all possible two-way crosses (for numbers of each breed, see Table 2). Sixty-seven crossbred ewe lambs were also used (see Table 5). The lambs were weaned at 75 ± 10 days of age. The ram lambs were then kept in individual cages and fed *ad libitum* for 120 days, lambs and their feed intake being individually weighed at 20-day intervals. Ewe lambs were group-fed with the same ration. A general information on the breeds used in this study and a detailed description of the management and feeding practices until weaning have been reported by Farid and Makarechian [3] and Farid *et al.* [4].

The ration consisted of 45.1% hay and 54.9% concentrate and mineral supplement. Feed was ground, mixed and sampled for proximate analysis. The ingredient and chemical compositions of the ration are presented in Table 1.

Table 1. Ingredient composition, chemical composition and gross energy of the ration

Ingredient	%	Chemical composition	% 90% D.M. Basis
Alfalfa	21.7	Crude protein	8.9
Wheat straw	23.4	Ether extract	2.1
Barley	30.3	Crude fiber	21.4
Dried beet pulp	23.4	Ash	7.9
Ammonium phosphate	0.5		
Salt	0.7		
		Gross energy	3.4 kcal/g

The least-squares method of fitting constants was used to analyse the data [9]. Since from the ewe lambs only the crossbreds were used, sexes were analysed separately. Constants were fitted for breeding groups (three straightbred and six crossbred groups for ram lambs and only six crossbred groups for ewe lambs) and age of dam. The traits studied were body weight, feedlot daily gain, feed intake and feed conversion in different periods. Pairwise tests of significance for differences between means were performed using the multiple range test of Duncan [1] as modified by Kramer [10].

RESULTS AND DISCUSSION

Ram lambs

Breeding groups. Least-squares means of feedlot daily gain in different 20-day intervals are shown in Table 2. There were significant differences among the different

Table 2. Least-squares means and standard errors of feedlot daily gain for straightbred and crossbred ram lambs in 20-day intervals

Days in feedlot	Overall mean	Breed of ram	Breed of ewe K	Breed of ewe M	Breed of ewe N	Significance of differences
1–20	63.0 ± 5.8	K	69.7 ± 12.9 a	64.8 ± 16.1 a	68.7 ± 25.7 a	None
		M	57.2 ± 23.3 a	63.7 ± 11.9 a	64.6 ± 18.4 a	
		N	47.0 ± 18.5 a	82.7 ± 18.2 a	48.2 ± 15.4 a	
21–40	138.1 ± 4.2	K	130.3 ± 9.2 bc	157.7 ± 11.5 ab	94.7 ± 18.4 cd	NK, NM, MM>all except KM and MK
		M	135.2 ± 16.7 abc	165.6 ± 8.5 a	162.2 ± 13.2 bc	KM>KN, NN
		N	174.1 ± 13.2 a	171.8 ± 13.0 a	87.4 ± 11.0 d	MK, KK, MN>NN
41–60	138.0 ± 4.2	K	141.2 ± 9.2 ab	156.8 ± 11.5 a	87.2 ± 18.5 c	NM, MM, KM, MN>MK, KN
		M	109.4 ± 16.8 bc	158.2 ± 8.5 a	146.0 ± 13.2 a	NK, KK, NN>KN
		N	145.2 ± 13.3 ab	164.7 ± 13.0 a	133.6 ± 11.1 ab	
61–80	118.0 ± 4.9	K	113.5 ± 10.8 a	123.7 ± 13.5 a	98.5 ± 21.7 a	None
		M	122.3 ± 19.6 a	150.0 ± 10.0 a	99.0 ± 15.5 a	
		N	121.2 ± 15.5 a	116.5 ± 15.3 a	119.1 ± 12.9 a	
81–100	103.4 ± 5.6	K	115.2 ± 12.3 abc	118.9 ± 15.3 abc	55.0 ± 24.5 c	NK>MN, NN, KN
		M	93.6 ± 22.2 abc	132.6 ± 11.3 ab	82.1 ± 17.5 bc	MM, NK>NN, KN
		N	133.7 ± 17.6 a	130.8 ± 17.3 ab	68.2 ± 14.6 c	
101–120	86.0 ± 4.5	K	78.5 ± 9.9 a	81.2 ± 12.4 a	87.9 ± 19.8 a	None
		M	77.0 ± 17.9 a	94.0 ± 9.2 a	86.7 ± 14.2 a	
		N	60.2 ± 14.2 a	122.4 ± 13.9 a	85.9 ± 11.5 a	
			Number of lambs			
	155	K	30	17	7	
	155	M	8	30	13	
		N	13	13	24	

All means within each period differ significantly ($p<0.05$) except those followed by the same letter.
K, Karakul, M, Mehraban, N, Naeini.

breed groups for feedlot daily gain in the second, third and fifth 20-day intervals. The average daily gain in the first period was very low (63.0 g). Since many lambs went off feed as a result of sudden changes of diet, weaning stress and individual feeding, it was decided to consider the first 20-day period as an adjusting phase.

Among the straightbred groups, Mehraban lambs showed the highest rate of growth in the feedlot, but differences were significant only in the second period (Mehraban> Karakul and Naeini) and the fifth period (Mehraban>Naeini). Karakul lambs had a significantly higher growth rate than Naeini lambs in the second period, but in other periods differences were variable and not significant.

The effects of the dam on feedlot daily gain of ram lambs can be seen by comparing the straightbred progeny for each ewe breed with the two corresponding crossbreds. These comparisons can be summarized thus from Table 2:

Mehraban dams – no significant difference in any period.
Karakul dams – only one significant difference, Karakul below Naeini X Karakul in the second period.
Naeini dams – two significant differences, Naeini below Mehraban X Naeini in the second period, and Karakul X Naeini below both Mehraban X Naeini and Naeini in the third period.

The lack of difference among groups of progeny of the same dam-breed, with various sire-breeds, indicates that the breed of dam has a great influence on the lamb's performance, even during the post-weaning period. This can be seen even more clearly in Table 3.

The average feedlot daily gain was almost the same during the second and third periods, then declined gradually during the last three periods. No obvious decline was observed in an experiment conducted by Farid *et al.* [5] with Karakul and Mehraban lambs in the last two 30-day intervals in a 120-day feedlot test. Makarechian *et al.* [11] reported that a period of 120 days was too long for fattening the Naeini lambs, but Karakul and Mehraban lambs continued to grow without showing any decline in their growth rate. The overall means of the feedlot daily gain were nearly constant in the last three 30-day intervals in their experiment. The gradual decline in daily gain during the last three periods in the present experiment might be due to the low energy content of the feedlot ration. The amount of feed consumed by lambs showed an approximately linear increase with age (Figs. 1, 2 and 3), and the decline in daily gain might have been

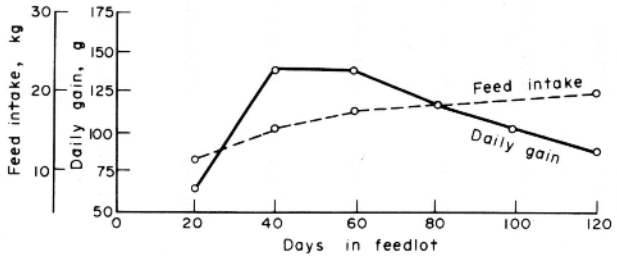

Fig. 1. Feed intake and feedlot daily gain in different 20-day intervals (overall means).

Table 3. Least-squares means and standard errors of total feedlot traits for straightbred and crossbred ram lambs and test of significance for differences between means

Feedlot trait	Overall mean	Breed of ram	Breed of ewe K	Breed of ewe M	Breed of ewe N	Significance of differences
Feedlot daily gain, g	124.4 ± 2.7	K	125.1 ± 5.9 bcd	139.3 ± 7.5 abc	83.9 ± 11.9 c	MM>all except NM, NK, KM
		M	115.1 ± 10.8 cde	151.6 ± 5.5 a	113.3 ± 8.5 de	NM>MK, MN, NN, KN
		N	143.6 ± 8.5 abc	145.9 ± 8.4 ab	102.1 ± 7.1 e	NK, KM>MN, NN, KN KK>NN, KN
Feed conversion, kg feed/kg gain	9.9 ± 0.3	K	10.3 ± 0.6 a	9.1 ± 0.7 ab	14.2 ± 1.2 c	
		M	10.2 ± 1.1 ab	8.2 ± 0.6 b	10.1 ± 0.9 ab	KN>all others
		N	8.4 ± 0.9 ab	8.7 ± 0.9 ab	9.6 ± 0.7 ab	KK>MM
Final weight, kg	32.1 ± 0.4	K	32.7 ± 0.8 a	35.0 ± 1.0 a	27.9 ± 1.6 bc	
		M	32.0 ± 1.5 ab	34.9 ± 0.7 a	29.1 ± 1.2 bc	NM, KM, MM, NK, KK>MN, KN, NN
		N	34.6 ± 1.2 a	35.2 ± 1.1 a	27.5 ± 1.0 c	NN>all except NN, KN
			Number of lambs			
	155	K	30	17	7	
		M	8	30	13	
		N	13	13	24	

All means within each trait differ significantly ($p<0.05$) except those followed by the same letter.
K, Karahul, M, Mehraban, N, Naeini.

Table 4. Least-squares means and standard errors of feed conversion for straightbred and crossbred ram lambs in 40-day intervals (kg feed/kg gain)

Days in feedlot	Overall mean	Breed of ram	Breed of ewe K	Breed of ewe M	Breed of ewe N	Significance of differences
1–40	10.8 ± 0.6	K	9.9 ± 1.3 a	8.4 ± 1.6 a	13.7 ± 2.6 ab	NN>all except KN
		M	8.7 ± 2.8 a	9.3 ± 1.2 a	12.7 ± 1.8 a	
		N	8.1 ± 1.9 a	7.1 ± 1.8 a	18.9 ± 1.5 b	
41–80	10.0 ± 0.3	K	9.9 ± 0.6 ab	9.5 ± 0.7 ab	12.3 ± 1.2 bc	MK>all except KN, MN
		M	12.7 ± 1.1 c	8.3 ± 0.6 a	10.0 ± 0.9 abc	KN>MM, NN
		N	9.5 ± 0.9 ab	9.5 ± 0.8 ab	7.9 ± 0.7 a	
81–120	15.4 ± 0.6	K	16.5 ± 1.4 a	15.4 ± 1.8 a	14.7 ± 2.9 a	
		M	17.6 ± 2.6 a	13.7 ± 1.3 a	17.5 ± 2.1 a	None
		N	16.5 ± 2.1 a	12.8 ± 2.1 a	13.6 ± 1.7 a	

All means within each period differ significantly ($p<0.05$) except those followed by the same letter.
K, Karakul, M, Mehraban, N, Naeini.

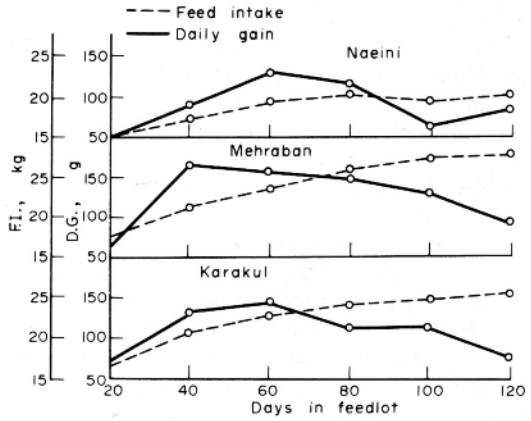

Fig. 2. Feed intake and feedlot daily gain of straightbreds in different 20-day intervals.

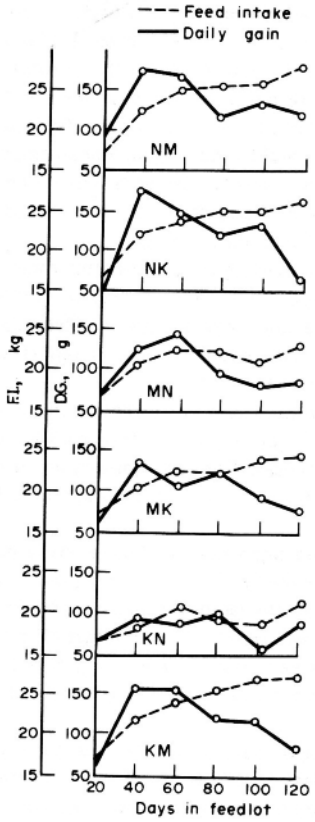

Fig. 3. Feed intake and feedlot daily gain of crossbred groups in different 20-day intervals.

caused by the fact that the ration could not provide the energy requirements of the lambs for full growth during the final stages. The objective was to use a feedlot ration fairly similar to those commonly used in the region, but because of this observed decline, the quality of the feed in future experiments will be improved. Since most of the lambs seemed to be somewhat overfat at the end of feedlot test, the fattening period will be reduced to 100 days in future experiments.

Least-squares means of feed conversion for straightbred and crossbred ram lambs in 40-day intervals are shown in Table 4. There were significant differences between breeding groups in the first and second 40-day periods, but in most of the comparisons the differences were not significant. In the first 40-day period, lambs born by Naeini ewes were less efficient than those in other groups, though the only significant difference was between straightbred Naeini lambs and all others except Karakul X Naeini. In the second 40-day period, however, the straightbred Naeini lambs were most efficient of all, though they differed significantly only from Mehraban X Karakul and Karakul X Naeini. The least efficient groups in the second period were Mehraban X Karakul and Karakul X Naeini. In the third period, no differences in efficiencies were significant.

Total feedlot performance. In order to make the results of the total feedlot performance comparable with future experiments, the data between 20 and 100 days in drylot were analysed for feedlot daily gain and feed conversion, and body weight after 100 days in feedlot was considered as the final weight of lambs, as is shown in Table 3.

Breeding group had a highly significant effect ($p<0.01$) on all the feedlot traits. Straightbred Karakul and Mehraban lambs did not differ in final weight, while both were significantly heavier than Naeini lambs. Among the straightbred lambs, Mehraban had significantly the highest rate of gain, followed by Karakul and Naeini. Makarechian *et al.* [11] reported that the feedlot daily gains of Karakul and Naeini lambs were similar and were significantly less than that of Mehraban lambs. Farid *et al.* [5] also reported the superiority of Mehraban lambs over Karakul lambs for feedlot daily gain.

Feed conversion of straightbred Mehraban lambs was significantly better than that of Karakul lambs, while straightbred Karakul and Naeini were similar. Makarechian *et al.* [11] did not find any differences for feed conversion among Karakul, Mehraban and Naeini lambs, but Farid *et al.* [5] agreed with the present results in reporting that Mehraban lambs were significantly more efficient than Karakul.

Comparisons between breeding groups (straightbred and crossbreds) with the same breed of dam for the total feedlot traits indicated that, except for feed conversion, the breed of sire did not cause any significant differences. For feed conversion, only the Karakul X Naeini group was inferior to both Mehraban X Naeini and straightbred Naeini lambs.

Comparison between all the breeding groups indicated that for feedlot daily gain, all the lambs born from Mehraban ewes, and also the Naeini X Karakul group had a similar rate of growth and all were significantly superior to the lambs produced by Naeini ewes. For feed conversion, the Karakul X Naeini group was significantly the least efficient. No other differences were found between the crossbred groups. The straightbred Naeini lambs were significantly lighter than all other groups in market weight, except those produced by the Naeini ewes.

Age of dam. Age of dam did not have a significant effect on the total feedlot performance (between 20 and 100 days in feedlot) of ram lambs. This is in agreement with the finding of Fahmy *et al.* [2] who reported that age of dam was not a significant

source of variation on final weight of lambs in feedlot. Vesely and Peters [13] reported a significant effect of age of dam on market weight of lambs, but not on total feedlot gain.

Analysis of feedlot daily gain in 20-day intervals indicated that age of dam was not a significant source of variation, except in the last period, in which age of dam accounted for 3.9% of the total variation, four and five-year old ewes producing lambs which gained about 30 grams more than the lambs produced by younger ewes, which were similar. In the other periods this factor accounted for not more than 1.8% of the total variation. For feed conversion in different periods, age of dam was a significant source of variation ($p<0.01$) only in the first period and accounted for 5.3% of the total variation. The lambs which were reared by the four and five-year old ewes were significantly more efficient than those reared by the two and three-year old ewes, which were similar.

Table 5. Least-squares means and standard errors of final weight and feedlot daily gain for crossbred ewe lambs and test of significance for differences between means

Classification		Number of lambs	Final weight kg	Daily gain g
Ram	Ewe			
K	M	9	28.0 ± 1.1 abc	99.7 ± 8.3 a
K	N	16	26.4 ± 0.8 c	86.0 ± 6.1 a
M	K	13	30.6 ± 1.0 a	106.9 ± 7.4 a
M	N	6	26.0 ± 1.4 c	96.7 ± 10.1 a
N	K	10	27.1 ± 1.1 bc	82.7 ± 8.1 a
N	M	13	30.0 ± 0.8 ab	98.5 ± 5.9 a

All means differ significantly ($p<0.05$) except those followed by the same letter.
K, Karakul, M, Mehraban, N, Naeini.

Ewe lambs

Breeding groups. Least-squares means for final weight and feedlot daily gain for crossbred ewe lambs are presented in Table 5. There were significant differences between breeding groups in final weight, but rate of growth was not affected by this factor. Mehraban X Karakul and Naeini X Mehraban groups were the heaviest at the end of feedlot period and were significantly heavier than lambs produced by Naeini ewes (Karakul X Naeini and Mehraban X Naeini).

Age of dam. This factor was not a significant source of variation in final weight and total feedlot daily gain of the ewe lambs.

The rate of growth and efficiency of gain were generally low in this experiment. In addition to the factors which were discussed earlier, the following factors might have had some bearing on the results. First of all, no classical selection for rate of growth or efficiency of gain has been performed on these breeds. Karakul and Naeini are mainly range sheep which are adapted to the poor range conditions and therefore may not be particularly efficient in utilizing the feedlot ration. Secondly, the experiment was conducted during the summer months and the environmental temperature exceeded 33°C on some days. The better growth and feed conversions of Karakul lambs in winter as compared with those fattened during the summer months in the same location is reported

by Ghorban *et al.* [7]. The better growth of lambs during the cold season as compared with those fattened during the warm season are also reported by Neathery [12] and by Gould and Whiteman [8].

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