

EWES REPRODUCTIVE PERFORMANCE, LAMB SURVIVAL AND BIOLOGICAL EFFICIENCY OF FINNSHEEP CROSSBREDS

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SUMMARY

Ewe performance of 1/4 and 1/2 Finnsheep (F) crossbred ewes and the *inter se* matings for two generations in comparison with local purebred Rahmani (R) and Ossimi (O) was evaluated under accelerated lambing system, with lambing every 8 months. The data represent seven breed groups and involved 6294 and 3116 records for 1633 R and 889 O ewes and their F crosses, respectively, over 21 years. Differences among breed groups were generally significant for conception rate (CR), number of lambs born per ewe lambing (NLB), kg born per ewe lambing (KGB), number of lambs weaned per ewe lambing (NLW), kg weaned per ewe lambing (KGW), lamb survival rates from birth to seven days (SR7D), 2 (SR2M), 6 (SR6M) and 18 months (SR18M). Season of mating had a significant effect on all reproductive traits studied. The interaction between season of mating and breed group significantly affected CR. Finnsheep crosses were consistently superior to local breeds, R and O, averaging higher by 9-13% and 14-20% for CR, 0.09-0.037 and 0.19-0.42 lamb for NLB, 0.41-0.69 kg and 0.51-0.82 kg for KGB, respectively. On the other hand, local lambs were superior to F-crossbred ones, averaging higher by 0-5% and 4-10% for SR7D, 2-8% and 2-8% for SR2M, 3-10% and 2-11% for SR6M and 4-15% and 5-17% for SR18M, for Rahmani and Ossimi, respectively.

Measures of the biological efficiency, annual kg of lambs produced at two and six months of age per kg of ewe live body weight, showed that F₁ crosses were more efficient than local breeds and other crosses, except that (O.FO)² group was slightly more efficient than F.O ewes.

Keywords: Finnsheep, crossbreeding, survival, reproductive, biological efficiency

INTRODUCTION

Egyptian sheep breeds, as subtropical breeds, are characterized by an ability to breed all the year round. However, their low prolificacy limits their annual lamb crop (Aboul-Naga *et al.*, 1988). They are of medium size and have small litter size ranging at birth from 1.03 to 1.40 (Galal *et al.*, 1996).

Finnish Landrace is one of the world most popular prolific breeds, and has been imported into over 40 countries all over the world (Fahmy, 1996).

In 1974, the Egyptian Ministry of Agriculture and Land Reclamation (MOA) started a crossbreeding program to improve the productivity of two native sheep breeds (Rahmani and Ossimi) through crossing with Finnsheep (F). The program aimed at the development of improved synthetic lines of sheep with higher reproduction rate than the local sheep and suited to the prevailing subtropical conditions (Mansour and Aboul-Naga, 1988).

The present study aimed to estimate the breed group effect on ewe reproductive performance and lamb survival and to investigate the effect of crossbreeding on biological efficiency of lamb production [at 2 (BEI2) and 6 (BEI6) months of age].

MATERIALS AND METHODS

Data were from two experimental stations of the Ministry of Agriculture and Land Reclamation. Data collected between 1974 and 1995 were included in the analysis.

The breeding plan was to cross Finn (F) rams with both Rahmani (R) and Ossimi (O) ewes to produce the F_1 's F.R and F.O, which were used to produce both reciprocal back crosses (R.FR and FR.R) and (O.FO and FO.O). The breed groups R.FR and O.FO were *inter se* mated for 1, 2 or 3 generations (designated by superscripts 1, 2 and 3 for the three generations, respectively).

A total of 1633 ewes and 6294 lambs of Rahmani and its F-crossbred and 889 ewes and 3116 lambs of Ossimi and its F-crossbred were utilized in this study.

Management. An accelerated lambing system, with mating every 8 mo, was practiced. The mating seasons were January, May, and September. Lambing took place in October, May and February. Lambs were weaned at 8 weeks of age.

Ewes and rams were first mated at about 18 months of age. At mating, ewes were randomly divided into groups, each of 30-35 ewes joined with a ram for a period of 35-45 days. If the ram was unable to serve the ewes, another ram of the same breed group replaced him after one week of his removal. At lambing, newborn lambs were identified and their weights, type of birth, sex

and pedigree were recorded. There was no culling based on performance criteria.

Sheep were fed according to the MOA's feeding standards (MOA, 1968) in all breeding stations. MOA's requirements are generally lower than those recommended by NRC (1985) and Ghoneim, (1967). Furthermore, the offered feed for breeding ewes did not differ from one genotype to another.

The measures of reproductive performance for individual ewes used in the analyses were conception rate (CR), number of lambs born per ewe lambing (NLB), Kg born per ewe lambing (KGB), number of lambs weaned per ewe lambing (NLW) and kg weaned per ewe lambing (KGW). Lamb survival rates from birth to 7 days (SR 7D), 2 mo (SR 2M), 6 mo (SR 6M) and 18 mo (SR 18M) were included in this study. Biological efficiency (BEI) in this study is defined as annual lamb's weights produced at 2 and 6 months of age per kg of ewe live body weight.

Statistical Analysis. The data were analyzed by the method of least squares utilizing Harvey's Mixed Model (1990). Ewes reproductive performance traits were fitted for breed group, ewe within the breed group, parity, location, year of mating, season of mating and their possible interactions.

Effects of ewes and residual terms were assumed to be random. All other effects were assumed to be fixed.

Lamb survival rates were fitted for breed group, location, sex of lambs, year of birth, season of birth and age of dam and their possible interactions.

RESULTS AND DISCUSSION

All main effects proved to be statistically significant sources of variation for all traits except sex for SR7D and SR2M and for location for CR, NLB, KGB, NLW and KGW. Only the interaction between breed group and season was a significant source of variation for CR and lamb survival rates.

All crosses were superior to pure breeds in CR, NLB, and KGB with differences ranging, respectively, from 9 to 13%, 0.09 to 0.37 lamb and 0.47 to 0.68 kg, in Rahmani groups, and from 14 to 20%, 0.19 to 0.42 lamb and 0.51 to 0.87 kg, in the Ossimi groups (Tables 1 and 2).

The performance of F.R and F.O ewes surpassed the other crosses for NLB. However, their NLB was less than the expected from the additive contribution of F genes. Aboul-Ela *et al.* (1988) found that, under the prevailing subtropical conditions, ova wastage is higher in F-crosses than in the local ewes and increased with higher ovulation rate. Despite their larger litters, other crosses were about similar to the F.R and F.O ewes in KGB, as expected from lighter lamb birth weight in the larger crossbred litters.

Table 1. Least squares means (LSM) and standard errors (SE) for ewe performance traits of Rahmani and its crosses with Finnsheep

Breed group	Component traits												Composite traits								
	CR				NLB				Lamb survival				KGB			NLW			KGW		
	LSM	SE	LSM	SE	SR7D	SR2M	SR6M	SR18M	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	
R	.67	.01	1.26	.02	.87	.01	.85	.01	.79	.02	.65	.03	3.82	.15	1.21	.07	17.73	.96			
F,R	.80	.02	1.63	.02	.86	.00	.81	.01	.69	.01	.61	.01	4.48	.07	1.32	.03	17.36	.42			
R,FR	.76	.02	1.35	.03	.82	.00	.77	.01	.69	.01	.54	.01	4.38	.08	1.11	.03	15.73	.50			
FR,R	.80	.03	1.42	.03	.87	.02	.83	.03	.76	.04	.58	.05	4.51	.10	1.23	.04	17.23	.60			
(R,FR) ¹	.77	.03	1.36	.04	.84	.00	.78	.01	.68	.01	.50	.02	4.29	.12	1.16	.05	16.35	.77			
(R,FR) ²	.79	.04	1.43	.05	.83	.01	.78	.01	.71	.02	.56	.02	4.50	.14	1.19	.06	16.86	.86			
(R,FR) ³	-	-	-	-	.84	.01	.79	.02	.70	.02	.54	.04	-	-	-	-	-	-	-	-	-

CR= conception rate, NLB = number of lambs born per ewe lambred, SR7D= lamb survival rate from birth to 7 days, SR2M = lamb survival rate from birth to 2 mo, SR6M = lamb survival rate from birth to 6 mo, SR18M = lamb survival rate from birth to 18 mo, KGB = kilograms born per ewe lambred, NLW = number of lambs weaned per ewe lambred and KGW = kilograms weaned per ewe lambred

Table 2. Least squares means (LSM) and standard errors (SE) for ewe performance traits of Ossimi and its crosses with Finnsheep

Breed group	Component traits												Composite traits								
	CR				NLB				Lamb survival				KGB			NLW			KGW		
	LSM	SE	LSM	SE	SR7D	SR2M	SR6M	SR18M	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	
O	.70	.02	1.11	.04	.87	.01	.80	.02	.75	.03	.68	.05	3.67	.17	1.01	.07	13.84	.96			
F,O	.86	.02	1.53	.03	.82	.00	.76	.01	.64	.01	.51	.02	4.54	.10	1.33	.04	16.77	.53			
O,FO	.84	.03	1.36	.04	.78	.01	.72	.01	.64	.02	.53	.02	4.42	.12	1.18	.05	16.01	.64			
FO,O	.89	.03	1.32	.05	.83	.01	.78	.02	.71	.03	.54	.04	4.18	.13	1.15	.05	14.95	.69			
(O,FO) ¹	.90	.03	1.31	.05	.76	.01	.73	.01	.64	.02	.51	.03	4.32	.14	1.08	.06	15.15	.77			
(O,FO) ²	.85	.04	1.30	.05	.79	.01	.77	.02	.73	.03	.63	.04	4.46	.16	1.10	.06	14.85	.87			
(O,FO) ³	-	-	-	-	.77	.02	.74	.03	.69	.04	.61	.05	-	-	-	-	-	-	-	-	-

Symbols as those outlined in footnote of Table (1).

Again, the light weight of the multiple born lambs may be the main contributing factor to the lower lamb survival rates for the crosses than the local lambs, even though they were not adjusted for type of birth. Differences in lamb survival rates between local and crossbreed lambs were more pronounced at SR2M and SR6M than at SR7D. Also, crossbred lambs born to local ewes were relatively heavier than the other crosses for SR7D, reflecting the better mothering ability of local ewes. In agreement with the present results, Smith (1977) and Cochran *et al.* (1984) found that non-prolific indigenous pure breeds exhibited higher preweaning survival rates than F-crosses lambs.

On the other hand, Dickerson *et al.* (1975); Magid *et al.* (1981); Osikowski *et al.* (1984); Borys *et al.* (1986); Lewis and Burfening (1988); Osikowski and Korman (1991); Borys and Osikowski (1992) and Korman (1994) reported that F-crosses were superior to the non-prolific purebreds in lamb survival from birth to weaning. Among Rahmani groups, Rahmani ewes occupied the third position for NLW after the F.R and FR.R ewes and the first position for KGW.

These results indicated that higher littersize in Rahmani crosses could not compensate for their lower lamb survival and weaning weights. Also, the lower lamb survival for the Ossimi crosses from birth to weaning reduced the level of superiority of the crossbreds over the Ossimi ewes at weaning compared with their rate at birth, ranging from 0.07 to 0.32 lamb and 1.01 to 2.93 kg for NLW and KGW, respectively. The performance of F.O ewes surpassed the other crosses for NLW and KGW. The high performance of the F-cross ewes relative to the indigenous pure breeds in CR, NLB and composite traits were reported elsewhere (Osikowski *et al.*, 1984; Borys *et al.*, 1986; Aboul-Naga *et al.*, 1988; Osikowski and Korman, 1991; Borys and Osikowski, 1992 and Korman, 1994).

As shown in Table 3, CR for September mating were higher for most breed groups than for January and May matings. Among Rahmani groups, seasonal differences in CR were more pronounced in F.R than in Rahmani ewes. Conception rate in F.R ewes showed 20, 0.0 and 21% higher than that in Rahmani ewes, in January, May and September mating seasons, respectively. Among Ossimi groups, the corresponding estimates were 30, 7 and 16%, respectively. Seasonal differences in CR were observed in all breed groups including the purebred Ossimi ewes. These results are in agreement with the findings of seasonal variation in estrous activity of Finn crosses reported by Aboul-Naga and Aboul-Ela (1985). The significant effects of the interaction between breed group and season on CR may point out to the inherent behavior of the breeds. While all studied genotypes were better in Sep, the difference between Sep and other seasons are greater in Finn-crosses, since Finnsheep are seasonal and Sep is closer to their mating season.

Table 3. Least squares means for conception rates of Rahmani, Ossimi and their F-crosses, by mating seasons

Breed group	Mating season		
	January	May	September
<i>Rahmani groups:</i>			
R	0.61	0.69	0.70
F.R	0.81	0.69	0.91
R.FR	0.72	0.72	0.83
FR.R	0.82	0.82	0.77
(R.FR) ¹	0.71	0.77	0.82
(R.FR) ²	0.67	0.84	0.86
<i>Ossimi groups:</i>			
O	0.69	0.57	0.83
F.O	0.99	0.64	0.96
O.FO	0.84	0.69	0.98
FO.O	0.97	0.75	0.99
(O.FO) ¹	0.92	0.70	0.99
(O.FO) ²	0.92	0.68	0.97

Estimates of the biological efficiency (BEI) are presented in Tables 4 and 5. The BEI estimates, both at 2 mo and at 6 mo were even higher in half F-crosses (F.R and F.O) than in local ewes (R and O), which was mainly due to higher twinning rate in F.R and F.O ewes, and to higher conception rate in F.R ewes.

In relation to F.R ewes, R, FR.R, R.FR, (R.FR)¹ and (R.FR)² ewes produced 73%, 76%, 69%, 64% and 66%, respectively, at weaning, and 79%, 73%, 67%, 66% and 68%, respectively, at 6 mo.

Table 4. Biological efficiency index, kg lamb per kg of surviving ewe, for Rahmani and its Finnsheep crosses

Genotype	FWT	WT2	BEI2	WT6	BEI6
R	40.36	12.94	0.212	23.80	0.363
F.R	40.80	13.22	0.292	23.30	0.461
FR.R	42.58	12.83	0.221	22.40	0.337
R.FR	40.20	12.83	0.202	22.40	0.308
(R.FR) ¹	40.20	12.69	0.188	22.70	0.306
(R.FR) ²	42.85	12.70	0.193	23.10	0.312

FWT = average female body weight at mating, kg,
 WT2 = lamb body weight at weaning, kg (Elshennawy *et al.*, 1998),
 BEI2 = (SR18M x CR x NLB x SR2M x WT2 x N)/FWT,
 WT6 = lamb body weight at 6 mo, kg (Elshennawy *et al.*, 1998),
 BEI6 = (SR18M x CR x NLB x SR6M x WT6 x N)/FWT and
 N = number of lambings/yr = 1.5, under the system of lambings/2 yr.

Table 5. Biological efficiency index, kg lamb per kg of surviving ewe, for Ossimi and its Finnsheep crosses

Genotype	FWT	WT2	BEI2	WT6	BEI6
O	36.99	12.72	0.218	24.00	0.385
F.O	39.72	13.07	0.238	24.10	0.390
FO.O	41.53	13.02	0.217	24.00	0.351
O.FO	39.81	13.02	0.215	24.00	0.347
(O.FO) ¹	40.54	12.93	0.221	23.20	0.376
(O.FO) ²	41.88	12.93	0.238	23.20	0.399

Symbols as those outlined in footnote of Table (4).

The estimates of BEI at 2 and 6 mo. confirmed the previous results of the individual reproductive rates, which indicated that ewes born to the Rahmani dams (F.R, R and FR.R breed groups) were superior to other breed groups.

In relation to F.O ewes, O, FO.O, O.FO, (O.FO)¹ and (O.FO)² ewes produced 91%, 91%, 90%, 93%, and 100%, respectively, at weaning, and 99%, 90%, 98%, 96%, and 102%, respectively, at 6 mo.

Although the estimate of BEI at weaning for FR.R was higher than that of Rahmani ewes rate of lamb mortality was also higher in the progeny of FR.R during the period from weaning till 6 mo. Thus, the estimate of BEI at 6 mo for Rahmani ewes was higher than that for FR.R ewes. The advantage of Rahmani ewes at weaning and at 6 mo compared to R.FR, (R.FR)¹ and (R.FR)² could be attributed to the relatively lower survival rate of those crosses progeny compared to the Rahmani progeny.

The higher estimations of BEI at 6 mo for (O.FO)² compared to the estimates for F.O may be due to the higher survival rate of the (O.FO)² progeny.

CONCLUSIONS

- Although pure F ewes are seasonal sheep in Finland, their cross-breds with local Egyptian sheep breeds were able to breed all the year round.
- In general, the performance of the Rahmani ewes was much closer to the performance of its ¼ F-crosses compared to the performance of Ossimi ewes relative to its ¼ F-crosses which showed significant improvement.
- It should be clear in mind that the superiority of 1/2 F-crossbred would require a complex breeding structure and management system that need to be investigated.

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الأداء التناسلي للنعاج، حيائية الحملان والكفاءة البيولوجية للأغنام الفنلندية الخليطة

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أجريت هذه الدراسة لتقييم أداء خلطان أغنام الرحمانى (ح) والأوسيمى (س) مع أغنام الفنلدى (ف) تحت الظروف المصرية. وقد اشتملت البيانات على ٧ مجاميع وراثية لكل من أغنام الرحمانى والأوسيمى وخطانها المختلفة مع الفنلدى المرباة تحت نظام الثلاث و لادات كل سنتين. جمعت السجلات المتاحة على مدى ٢١ عاماً لعدد ١٦٣٣ نعجة و ٦٢٩٤ حمل من سلالة الرحمانى وخطانها ولعدد ٨٨٩ نعجة ٣١١٦ حمل من سلالة الأوسيمى وخطانها.

كان تأثير التركيب الوراثى معنوياً على جميع صفات الأداء التناسلى للنعجة وكذلك على النسب الحياتية للحملان من الميلاد وحتى عمر ١٨ شهراً وفي حين اظهر موسم التلقيح تأثيراً معنوياً على جميع صفات الأداء التناسلى للنعجة، كان للتداخل بين موسم التلقيح والتركيب الوراثى تأثيراً معنوياً على معدل الحمل فقط.

أظهرت خلطان الفنلدى تميزاً على الأنواع المحلية (الرحمانى والأوسيمى) بمقدار تراوح من ٩-١٣٪، ١٤-٢٠٪ لمعدل الحمل ومن ٠,٠٩-٠,٣٧ حمل، ٠,١٩-٠,٤٢ حمل لعدد الحملان المولودة للنعجة التي ولدت ومن ٠,٤١-٠,٦٩ كجم، ٠,٥١-٠,٨٢ كجم لوزن الحملان المولودة للنعجة التي ولدت، على التوالي. وعلى الجانب الآخر تميزت الحملان المحلية على الحملان الخليطة بمقدار ٠,٠٠-٥,٠٠٪، ٤,٠٠-١٠,٠٠٪ لمعدل الحياتية من الميلاد حتى ٧ أيام، و ٢-٨٪، ٢-٨٪ لمعدل الحياتية من الميلاد حتى شهرين، و ٣-١٠٪، ٢-١١٪ لمعدل الحياتية من الميلاد حتى ٦ أشهر، و ٤-١٥٪، ٥-١٧٪ لمعدل الحياتية من الميلاد حتى ١٨ شهر، للحملان الرحمانى والأوسيمى، على التوالي.

أظهرت مقاييس الكفاءة البيولوجية أن خلطان ٢/١ ف كانت أكثر كفاءة من كلا من الأغنام المحلية والخطان الأخرى ما عدا بين مجاميع الأوسيمى حيث تميز الخليط (س.ف.س) عن الأوسيمى والخطان الأخرى.