Improving subtropical Egyptian fat-tailed sheep through cross-breeding with the prolific Finnsheep

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Background

Finnsheep (F) are well characterised by their high prolificacy, fertility and early sexual maturity. In the sixties and seventies, Finnsheep were introduced to many temperate countries and a few subtropical ones amounting to some 40 countries in different continents (Maijala, 1984). Different reviews clearly showed that the high fertility of Finnsheep for both males and females has expressed itself in various countries and has proven to be heritable in different genetic backgrounds. On the other hand, growth rate, carcass traits and survival rates, especially for pure F were not satisfactory. Maijala (1984), summarised the results of different cross-breeding trials involving Finnsheep as follows: an increase of 1 percent in F blood was associated with an increase in litter weight weaned/ewe mated by 1.4 percent and lambs born/ewe mated by 1.2 percent.

Egyptian sheep are subtropical fat-tailed sheep characterised by satisfactory fertility and ability to breed all year round, but have low prolificacy and growth rate. The Nile-Valley Ossimi (O) and Rahmani (R) breeds have a conception rate of more than 80 percent when bred once/year and over 70 percent when bred every eight months (Aboul-Naga and Aboul-Ela, 1985). Their prolificacy ranges from 1.15 to 1.25/ewe. The population of the two breeds is about 2.5 m head raised mainly by small farmers in mixed farming systems in flocks of three to ten head and fed on agro-by-products with some fodder supplement, whenever available, e.g. low to medium input production system. Active breeders in the villages are shepherds who own 30–100 head and keeping rams. Income from raising sheep by small farmers is mainly from their lamb production; lambs are usually marketed after weaning (3-4 months) and the market price is determined per head.

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Cross-breeding trial

The trial was initiated early in the seventies by the Animal Production Research Institute, Ministry of Agriculture (MOA).

Breeding objectives

The breeding objectives were to increase the prolificacy of Ossimi and Rahmani breeds usually raised in small farm conditions, yet keeping their ability to breed all year round, in other words, improve number of lambs weaned/ewe/year. There was no formal study to set the breeding objectives and their numerical economic values. The breeding objective of increasing litter size was decided based on the research workers' intuition.

Net income of small holders in full cost feeding conditions was estimated as 1.89 percent for a twining rate of 1.15 (average twining rate for local breeds), 7.74 percent for a rate of 1.25 and doubled to 16.2 percent for twining rate of 1.40 percent (Shehata, 1996).

Breeding plan

The Plan was to cross the local ewes to the imported Finn rams. The first cross ewes and rams were backcrossed to the local to produce a quarter Finn, three-quarters local (¼ F ¾ L) from each breed group. The ¼ F ¾ L cross was either *inter se* mated for some generations, involved in selection programmes for improving number of lambs weaned/ewe/year and establishing a new breed type with better lamb production, or utilised as a dam breed to be mated to terminal sire (Suffolk Cross, which is available at MOA) to produce fat lambs. The ¼ F ¾ L lambs were thought to be suitable for the local conditions based on the following criteria:

- their prolificacy would not be too high and twin born lambs can be managed easily by small farmers;
- they can stand the prevailing environmental conditions better than higher Finn crosses;
- the ewes will retain from their local parents, the ability to breed all year round;
- lambs produced have a recognisable fat tail, which has a consumer preference; and
- the genotype could easily be propagated using the ½ F rams produced in nucleus flocks on state farms or the breeders' flocks. One imported ram is estimated to produce three to four thousand ¼ F ewes in the breeders' flocks over five to seven years.

The last criterion is crucial in large-scale development programmes in order to improve lamb production from local sheep. The production plan does not involve artificial rearing of the lambs or hormonal treatment of the ewes. Later on, the component of using terminal sire on ¼ F ewes was excluded from the breeding plan, as the results were not encouraging and were impractical in small farm conditions.

The trial was carried out at Sakha Animal Production Research Stations starting in 1974 utilising four Finn rams, imported through an FAO project (UAR 49). With the encouraging on-station results of the Finn crosses, this was later followed by the importation of successive batches of Finn rams and ewes from Finland in collaboration with FINIDA (40 rams and 24 ewes). The Finn ewes were imported only for experimental work.

All Finn cross-bred ewes were mated every eight months, as were the local ewes. The mating seasons were September, May and January, each lasting for 35-45 days. All the Finn rams were mated naturally to the fat-tailed local ewes after a training period of copulating with the fat-tailed ewes.

Reproduction performance of Finn crosses

Aboul-Naga *et al*. (1989) reported data from eighteen successive seasons (5 589 records). The pure Finn ewes showed the lowest fertility (e.g. ewe lambed / ewe exposed), on the other hand, they were able to maintain their high prolificacy in subtropical conditions (2.43 lambs / ewe lambed). Lamb losses, however, were so high that Finn sheep had a lower advantage over the local breeds in number of lambs weaned / ewe exposed / year (Table 1).

The first cross ewes had significantly higher prolificacy than the local breeds by 0.37 and 0.30 lambs / ewe lambed for FR and FO, respectively. The ¼ F ewes were significantly more prolific than their respective locals. They gave birth to 0.11–0.19 more lambs and weaned 0.07–0.17 more lambs / ewe lambed than the local breeds. The advantage of ¼ F ewes over the locals was more detectable in annual lambs weaned / ewes exposed to range from 0.27 to 0.50 / lambs / ewes yearly.

Table 1. Reproductive performance of Finn crosses with Egyptian sheep breeds three times/two years.

Breed group	EL / EE*	LB / EE	LB / EL	LW / EL	LW / EE / year
F	0.50	1.26	2.43	1.71	1.32
R	0.72	0.92	1.31	1.17	1.23
FR	0.77	1.27	1.68	1.46	1.65
R . FR	0.80	1.11	1.42	1.27	1.50
FR . R	0.80	1.11	1.44	1.28	1.49
(¼ F . ¾ R) 2	0.76	1.06	1.40	1.24	1.40
O	0.68	0.81	1.22	1.08	1.08
FO	0.75	1.11	1.52	1.35	1.47
O . FO	0.72	1.00	1.41	1.25	1.34
FO . O	0.80	1.02	1.34	1.81	1.37
(¼F . ¾O) 2	0.65	1.26	1.42	1.19	1.38

* EL: ewe lambed; EE: ewe exposed to ram; LB: lambs born; LW: lambs weaned

The ¼ F groups were slightly less prolific than the first cross and detectably of better fertility. Their performance was better than expected, assuming a linear relationship with a proportion of Finn blood.

The *inter se* mating group of ¼ F ¾ R was of slightly lower fertility than their parents. Meanwhile they gave birth to 9 percent more lambs than the R, and in the end had an advantage of 17 percent for the annual number of lambs weaned compared to the local counterparts. Similarly, the (¼ F ¾ O) 2 ewes showed lower fertility than their parents, but weaned detectably more lambs than the local O ewes.

Although Finn crosses showed good ability to breed every eight months, their reproductive performance varied greatly from one season to another. September mating showed significantly better performance among different Finn crosses. Lambs weaned / ewe were 1.7, 1.29 and 1.22 from autumn, winter and summer matings, respectively.

Adaptability of Finnsheep and their crosses

As expected, Finn ewes showed detectably lower tolerance to prevailing hot conditions than the local sheep and showed higher physiological response than their half-sibs raised in Finland (Aboul-Ela *et al.*, 1987).

Physiological parameters for ½ F were much closer to the local sheep than to the Finn. Those of ¼ F were almost similar to the local, which indicate their good adaptability to the prevailing subtropical conditions.

Fattening and carcass performance

The results of a series of fattening trials showed that the cross-bred lambs attained a slaughter weight of 40 kg two months earlier than the local lambs. They also had better carcass performance, however, local carcasses were leaner, most of their fat being deposited in their fat tail.

Genetic Components: Utilising the estimates of genetic components to predict the performance of synthetic Finn crosses, Mansour and Aboul-Naga (1988), showed that their performance was somewhat less than that expected from additive contribution of F genes. Deviations from the expected means were higher in the F_1 than with back crosses. Such discrepancy in expectation for the high Finn crosses was attributed to early embryonic mortality in highly fecund ewes in subtropical conditions, and may also have been due to limited nutrient capacity inherited from their local parents. They indicated positive individual heterosis in the breeding activity of F cross-bred ewes.

On-farm trials

With the encouraging experimental results on ¼ F crosses, batches of ½ F rams (30) were sold to shepherds in two Nile-Delta provinces (Sharkia and Ismalia) during the period 1982 to 1992 to produce ¼ F ewes and rams and to disseminate them to randomly chosen small farmers.

Furthermore, 14 pure-bred Finn rams were distributed to large breeders having >50 lambs and interested in breeding activities, to investigate the possibilities of producing ½ F rams commercially.

A parallel programme was initiated in 1983 to provide 67 small farmers with three to five ¼ F ¾ L ewes plus one ram on a two year easy credit in the context of a rural development programme. Preference was given to small farmers having two to four local ewes to ease the breed group comparison.

Periodic visits were carried out to breeders to follow-up the performance of ¼ F cross in breeders conditions and for economic and financial evaluation of input/output relationship.

Performance of Finn crosses in farmer conditions

As expected ½ F rams performed much better than the pure Finn ram, especially when they were raised outdoors with shepherds (58 percent conception rate versus *26* percent*)*.

The ¼ F ewes raised with small farmers for two to seven crops and running with ¼ F rams all the time, have lambing intervals of 295 days versus 305 days for local ewes (Table 2). The number of lambs born/ewe/year averaged 1.65 for Finn crosses with a clear trend to augment with increase in age. Lambs weaned/ewe/year were 0.20 higher than the local ewes (Metawi, 1996). The advantage in litter size of ¼ F increased with age and with decrease in flock size. The weight of cross-breed lambs at four months of age was higher for small farmers than large herds. The litter size did not affect lamb's weight at marketing. Farmers preferred the ¼ F lambs' meat as it was better than the local lambs due to their low fat content.

The author added that performance of cross-breed ewes varied greatly between small holders and was directly associated with availability of feed stuff over the year.

Table 2: Reproduction performance of ¼ F ewes in small farm conditions.

Trait	Local	¼ Finn
No. of records	457	630
LB/EL	1.23	1.34
LW/EL	1.05	1.17
Lambing interval (day)	305	295
Age at first lambing (day)	537	558
LW/EE/Yr.	1.26	1.45

Biological and economic evaluation

Almahdy (1996) in a simulation study evaluating the biological and economic efficiency of Finn crosses versus the local ewes, in two different management systems, found that crossing with Finn has improved both biological and economic returns from local sheep. Biological efficiency (TDN/E) was significantly improved by 9.3 percent for one crop/year and 11.7 percent when production was three crops/two years. Economic efficiency (GM/E) was highly improved by 63 percent and 83 percent under the two systems of mating, respectively.

Table 3: Biological and economic evaluation of ¼ Finn Crosses under different management systems.

Breeding Group	One Crop/year		Three Crops/Two years	
	TDN/E	GM/E	TDN/E	GM/E
L	14.2	65.9	15.3	62.5
¼ F	12.5	107.6	13.0	114.3

Meanwhile, the financial analysis of the on-farm data by Metawi (1996) showed that the IRR increased from 14 percent for local flocks to 18.2 percent from cross-breed flocks. One of the factors affecting IRR was the weaned lamb sale price on the market, which was in favour of the local lambs due to the size of the fat-tail. Price difference was significant in the Sharkia Province, while insignificant for the Ismalia Province. Price differences were modified when lambs were fattened before marketing.

Lessons learnt

- Cross-breeding programmes involving crosses with specific breed combination are difficult to sustain at the farmer level. A range of combinations should be envisaged, e.g. in the present programme a 12-37 percent range would be allowed and probably investigated rather that the 25 percent F genetic;
- A structure must be established to guarantee the flow of the desired genotypes. In the present case, non-sustainability evolved as it depends mainly on state institutions to provide the exotic genotype;
- Enhancement of improved cross-breeding genetic material should be accompanied by access of breeders to inputs, e.g. regular availability of feed stuff;
- Phenotypic characters of local breeds involved in the consumer preference and consequently in market price, should be taken into consideration in the cross-breeding programmes with exotic breeds;
- A lower portion of the exotic temperate blood seems more suitable for crosses in subtropical conditions.

Breeding plans involving more than two breeds are not recommendable for small farmers in developing countries.

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