Biological and economic evaluation of sheep production systems on newly reclaimed land in Egypt

Ahmed A.M.

in

Mena Y. (ed.), Castel J.M. (ed.), Morand-Fehr P. (ed.).
Analyse technico-économique des systèmes de production ovine et caprine : méthodologie et valorisation pour le développement et la prospective.

Zaragoza : CIHEAM / FAO / Universidad de Sevilla
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 70

2006
pages 53-56

Biological and economic evaluation of sheep production systems on newly reclaimed land in Egypt

A.M. Ahmed
Desert Research Center, P.O. Box 11753, Mataria, Cairo, Egypt

SUMMARY – The main objectives of the present study were to evaluate, both biologically and economically, a commercial flock of Barki sheep raised in a newly reclaimed desert area and to use these evaluations to investigate the response of the production system to technology interventions, mainly genetic and management. Six scenarios were created by combining factorially frequency of lambing (every 8 or 12 months) and breeds involved (pure Barki, Barki ewes and Suffolk rams and Finn x Barki ewes mated to terminal Suffolk rams, i.e. 1,2,3 stratum system) in the breeding scheme. Biological measures considered were: (i) kilograms of lambs marketed per ewe joined; (ii) kg of liveweight marketed per ewe joined; (iii) kg of lambs marketed per kg of ewe joined; (iv) kg of liveweight marketed per kg of ewe joined; (v) kg of DM needed per kg of lambs marketed; and (vi) kg of DM needed per kg of liveweight marketed. The internal rate of return (IRR) and gross margin per head of breeding ewes were used as measures of the project worth. Both biological and economic evaluation criteria improved as frequency of lambing increased and more breeds were used for crossing in the system.

Keywords: *Barki, production system, internal rate of return, gross margin, Egypt.*

RESUME – *"Evaluation biologique et économique du système de production ovine sur des terres récemment mises en valeur en Egypte". Les principaux objectifs de la présente étude sont d'évaluer, à la fois biologiquement et économiquement, un troupeau commercial élevé dans une zone désertique récemment mise en valeur et d'utiliser ces évaluations pour rechercher la réponse la plus appropriée au niveau technique, principalement en termes de génétique et de conduite. Six scénarios sont proposés en combinant la fréquence factorielle des agnelages (chaque 8 ou 12 mois) et les races concernées (pure Barki, brebis Barki et mâles Suffolk, et brebis Finnoises x Barki montées par des béliers en croisement terminal Suffolk, à savoir les systèmes 1,2,3) dans le schéma d'élevage. Les paramètres biologiques considérés étaient : (i) les kg d'agneaux commercialisés par brebis ayant mis en bas ; (ii) les kg de poids vif commercialisés par kg de brebis ayant mis en bas ; (iii) les kg d'agneaux commercialisés par kg de brebis ayant mis bas ; (iv) les kg de poids vif commercialisés par kg de brebis ayant mis bas ; (v) les kg de matière sèche nécessaires par kg d'agneau commercialisé ; et (vi) les kg de matière sèche nécessaire par kg de poids vif commercialisé. Le taux de rentabilité interne (IRR) et la marge brute par tête de brebis à la reproduction sont utilisés pour mesurer la validité du projet. Les critères d'évaluation à la fois économique et biologique se sont améliorés de manière concomitante avec la fréquence des agnelages et avec l'augmentation du nombre de races utilisées dans le système pour les croisements.*

Mots-clés : *Barki, système de production, taux de rentabilité, marge brute.*

Introduction

The human population in Egypt has been increasing at a rapid rate of 2.1% during the last ten years as reported by The Central Agency for Public Mobilization and Statistics (CAPMAS, 2002), a trend that increases the pressure on meat consumption and widens the food gap. Total annual red meat expected to be produced in year 2002 was 660 thousand tons, while the expected red meat demand was projected at 985 thousand tons. To narrow this gap, improving the performance of livestock is one option within the context of the current production systems as well as considering other systems that best make use of the available resources. This study was carried out to evaluate the biological, financial and economic performance efficiencies of Barki sheep under conditions of the newly reclaimed land, and to assess proposed production systems varying mainly in frequency of lambing and use of exotic breeds to improve litter size and growth rate.

Materials and methods

Design of the study and the simulated systems

Two variables were considered factorially to generate six production systems. The first is frequency of lambing with two levels, once every 8 months and once every 12 months, and the second is the mating system with three levels, as follows: (i) line breeding of Barki sheep; (ii) two-breed crossing system where Barki (B) ewes were mated partly to Barki rams to produce replacements and partly to mutton rams (Suffolk, S) to produce market lambs. All F_1 and surplus male lambs are fattened, while the females are sold without fattening; and (iii) three-breed crossing system where Barki ewes were mated to Finn (F) rams. F_1 ewes were mated to terminal Suffolk rams. All three-breed crossbred lambs and surplus B and F_1 were fattened.

A hyphenated number designated each system. The digit to the left indicated the number of the breeds in the system and the number to the right the lambing interval, e.g. 3/8 indicate a system where three breeds were used and lambing took place once every 8 months.

Technical coefficients

Estimates for biological performance reported in the previous studies as well as those obtained in the present study (lasting for two successive years) were used as technical coefficients for developing the simulated production systems.

Criteria for system evaluation

The biological criteria for the system evaluated were: kg lambs marketed per ewe joined (KLMEJ), kg liveweight marketed per ewe joined (KLWMEJ) (including culls), kg lambs marketed per kg of ewe joined (KLMKEJ), kg liveweight marketed per kg of ewe joined (KLWMKEJ), kg dry matter needed per kg of lambs marketed (KDKLM) and kg dry matter needed per kg of liveweight marketed (KDKLWM). The economic criteria were: (i) internal rate of return (IRR), which is one of the main methods of economic analysis applicable to long term projects; and (ii) annual gross margin (GM) per ewe. IRR is a measure which takes time value of money in consideration and relies on the use of discounting procedures. Calculations of IRR can be done by computer programs and also can be done by trial and error by the formula:

IRR = (lower discount rate) + (difference between the two rates x NPV for lower rate / absolute difference between the two NPVs calculated).

Annual gross margin per ewe is calculated as follows: GM = total gross output - total variable costs.

Production system investigated

The production system is determined by the germplasm available, climate and physical environment and by the economic conditions prevailing in the area.

Assumptions made to make statistical and economic analysis were:

(i) The basic-stock breed used is pure Barki.

(ii) Stable flock size (number of breeding ewes ready for mating every season) is 500 breeding ewes at different ages.

(iii) The flock is raised in newly desert reclaimed area.

(iv) The feeding system is mainly dependent upon grazing green fodders, which are available in winter (berseem) and during summer (millet), in addition to berseem hay and rice straw.

(v) Shearing is in April.

(vi) The mating season lasts for 60 days in the 12-month lambing system and for 40 days in the 8-month lambing system.

(vii) Barki breeding rams will stay in the flock for two breeding seasons and then are culled just after the breeding season to avoid inbreeding, i.e. culling rate among Barki breeding rams will be 50%. While culling rate among all breeding ewes will be 14% in 12-month lambing system (productive life-time 6-8 years), and 17% in 8-month lambing system (productive life-time 6 years).

(viii) Annual mortality among Barki breeding rams is 3.0%.

(ix) Ram/ewe ratio is 3 : 100 plus 20.0% of rams as reserve.

(x) Annual manure production is 1.0 m^3 per ewe and offspring until weaning age.

(xi) Average mature body weight of Barki breeding ewe and ram is 42.5 kg and 60.0 kg, respectively (Aboul-Naga, 1985; Galal, 1987; Mokhtar *et al.*, 1991).

(xii) Annual mortality among Barki ewes is 4.0%.

(xiii) Fattening period for all systems is 3 months.

(xiv) Duration of the production cycle in case of 12-month lambing system is 365 days, while in the case of 8-month lambing system is 243 days. The full cycle is partitioned into four periods according to the physiological status of the ewe. These periods were: breeding, early and mid-pregnancy, late pregnancy and early lactation and dry period.

Results and discusion

Annual biological performances of ewes under different systems investigated are shown in Table 1. The 3-breed and 8-month lambing (3/8) production system was the highest performer among all systems investigated in all biological traits studied, while 1/12 production system was the lowest. All production criteria improved as the number of breeding strata increased and lambing frequency decreased.

Table 1. Annual biological performances of production systems investigated

Trait†	Production systems					
	1/12	2/12	3/12	1/8	2/8	3/8
KLMEJ	17.6	19.5	25.0	23.0	25.8	34.5
KLWMEJ	24.6	26.4	32.0	31.7	34.6	43.3
KLMKEJ	0.4	0.5	0.6	0.5	0.6	0.8
KLWMKEJ	0.6	0.6	0.8	0.8	0.8	1.0
KDKLM	34.0	31.3	26.3	30.2	27.0	22.7
KDKLWM	24.3	23.2	20.5	21.8	20.2	18.1

†KLMEJ = kg lambs marketed/ewe joined; KLWMEJ = kg live weight marketed/ewe joined; KLMKEJ = kg lambs marketed/kg of ewe joined; KLWMKEJ = kg live weight marketed/kg of ewe joined; KDKLM = Kg dry matter per kg of lambs marketed; KDKLWM = kg dry matter per kg of live weight marketed.

Comparing each pair of the same stratum shows the effect of accelerating the lambing on the biological performance of the different systems. The differences between estimated values of different traits investigated of the same number of strata under different management (12-month or 8-month lambing) increased as the number of strata increased in all criteria except kg live weight per kg of ewe joined where the difference was constant, which indicates that there is an interaction between number

of strata and accelerating lambing. However, the experimental design does not offer a test of significance for the interaction.

Comparing the economic measures (IRR and GM) earned from the same strata under the 12-month or 8-month lambing systems shows that as numbers of strata increased the difference between once-in-a-year and once-in 8-month of the same strata increased, that difference being 6.2, 6.7 and 7.7 in IRR earned, while the difference was LE 13.27, LE 15.5 and LE 24.43 in gross margin (LE: Egyptian pound). That also shows some interaction between stratification and acceleration of lambing (Fig. 1).

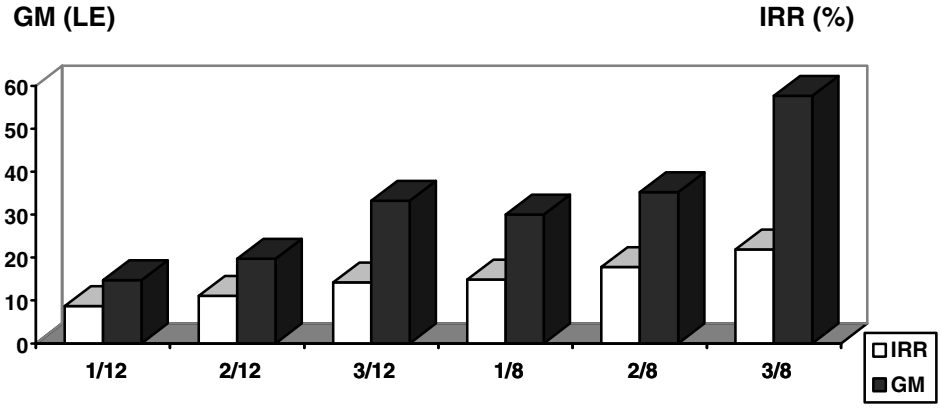

Fig. 1. Internal rate of return and gross margin of simulated production systems (1 LE ≅ 0.139 €).

Conclusion

The conclusions drawn from the study are:

(i) Crossbreeding with prolific and mutton breeds in addition to more frequent lambing are efficient methods for improving biological and economic performances.

(ii) Under the conditions stated, only the 2/8 and 3/8 systems of production offer better investment opportunities as judged by IRR estimates (17.8% and 21.9%).

(iii) IRR earned from these systems ranges from 8.7% to 21.9% compared with contemporary interest rates on Bank deposits of 7% to 11%.

(iv) Even under relative modest biological performances assumed for the crosses in the present study the three stratum 8-month lambing system (3/8) were the most profitable system among the production systems investigated.

(v) The effect of more frequent breeding on biological and financial performances partially depends on the number of strata in the system.

References

Aboul-Naga, A.M. (1985). Crossbreeding for fecundity in subtropical sheep. In: *Genetics of Reproduction in Sheep,* Land, R.B. and Robinson, D.W. (eds). Butterworths, London.

Central Agency for Public Mobilization and Statistics (2002). *Statistical Book*. Arab Republic of Egypt, 90 p.

Galal, E.S.E. (1987). Sheep and goat production research in Egypt. In: *Small Ruminants in the Near East,* Qureshi, A. and Fitzhugen, H. (eds). FAO Paper 54, Vol. 1, Animal Production and Health, Rome, Italy.

Mokhtar, M.M., Mansour, H., Younis, A.A. and El-Gabbas, H.I. (1991). Growth and mature size in fat-tailed Barki sheep, Egypt. *J. of Anim. Prod.,* Vol. 28, No. 1: 39.