Economic significance of some productive traits in Sarda sheep farming systems

Natale A., Oppia P., Sanna S.R., Carta A., Ligios S.

in

Gabiña D. (ed.).
Analysis and definition of the objectives in genetic improvement programmes in sheep and goats. An economic approach to increase their profitability

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 43

2000
pages 27-31

Economic significance of some productive traits in Sarda sheep farming systems

A. Natale*, S.R. Sanna, P. Oppia*, A. Carta** and S. Ligios****
*Ass.ne Reg.le Allevatori della Sardegna, Via Cavalcanti 8, 09128 Cagliari, Italy
**Ist. Zootecnico e Caseario per la Sardegna, Reg. Bonassai, 07040 Olmedo, Italy

SUMMARY – A description of Sardinian dairy sheep farming systems and an analysis of the farm economic results were reported in order to verify the genetic improvement objectives chosen for Sarda sheep. Milk yield per ewe showed, by far, the greatest effect on sheep activity margins of Sardinian farms. So, the selection judgements expressed in the early 70s for Sarda sheep, even in the light of recent milk price decrease, still preserve their economic importance.

Key words: Sarda sheep, milk, farm revenue, genetic improvement.

RESUME – *"Importance économique de certains caractères productifs dans les systèmes d'élevage des brebis Sardes". Les caractéristiques des systèmes d'élevage des brebis laitières en Sardaigne et une analyse des résultats économiques des fermes ont été décrites dans le but de vérifier les objectifs de sélection de la brebis Sarde. La production laitière par brebis s'est clairement révélée le caractère ayant la plus grande influence sur le résultat économique des fermes ovines en Sardaigne. Ainsi, l'objectif principal de sélection choisi dans les années 70 pour la race ovine Sarde, maintient encore aujourd'hui son importance même en présence d'une forte réduction du prix du lait de brebis.*

Mots-clés: *Brebis Sarde, lait, résultats économiques, amélioration génétique.*

Introduction

The definition of breeding objectives is the first step when planning the breeding programme of a breed and it should be always fulfilled taking into major account the economic circumstances of farms interested in that breed.

In the early 1970s, the milk yield recorded after a suckling period of 30 days (in the milking period only) was detected as the main goal for the Sarda breeding program. Only in recent years the annual genetic gain achieved within the selection nucleus introduced some concern about some other important traits (milk composition, mechanical milking aptitude, etc.). Recently, the consequences of the reduction of EU sustenance to cheese export, included in the "Uruguay Round" GATT agreements, produced an 18% decrease of milk market price in Sardinia, so giving additional interest to this study.

Since 1992, the Associazione Regionale Allevatori della Sardegna (Sardinia Breeders Association, ARAS) build up a wide program (Natale, 1996), harmonic to its technical advisory plan, to collect and analyse all technical and economic information available on dairy sheep farms. Currently, the structural, productive and economic figures are recorded on 1000 farms, among the 5000 involved in the ARAS extension services program, providing to the advisors involved, an effective tool to perform technical comparisons between farms. Such a database, although in a development phase both in terms of number of farms, of inputs needed and of outputs achievable, is the soundest available source to validate the Sarda genetic improvement objectives. In order to assess the role of milk yield as the main objective for genetic improvement of Sarda sheep, a description of Sardinian production systems and an analysis of the technical and economic results were performed.

Origin of the data

The analysed data belong to Sardinian dairy sheep farms scattered over the 4 provinces of Sardinia and they were recorded in 1997. Even if the complete database included 1472 farms, due to the several degrees of involvement of farmers and technicians in the advisory programme, all basic information was available only on 772 farms and those were retained for the study. Only a few of them were involved in the Sarda Flock-Book activities and concurred actively to the breeding program, so data from milk recording database were not used in the current analysis.

Ewe numbers, lambings and other production facts were recorded monthly by interview and were used to obtain sales figures by multiplying them by market prices. The market prices, due mainly to the technical purposes of the advisory programme, were standardized for the whole sample by using prices published monthly by the Local Trade Organization.

The lack of individual records brought to some approximations in calculating technical indexes: (i) an average date of lambing was not available so, the percentage of adult ewes lambed at the 1st of January was used to describe the grouping of the lambings; and (ii) the number of lambed ewes can also be considered, with little approximation, the number of ewes that were actually milked. Differently, the number of milked ewes is the average number of ewes at milking over all the milking period, a fact of major interest for technical judgement about the use of manpower or concentrates, but hardly useful in the estimation of individual yields. As well, the individual lactation length was not available and was replaced by the duration of the milking period per flock. Hence, to obtain an average daily yield per milked ewe, total milk sold was divided by the flock milking period and by milked ewes. Average annual yield per milked ewe was obtained by multiplying this average daily value for the flock milking period and reflects only a potential yield. On the other hand, milk yield per ewe or per lambed ewe was calculated by dividing the milk sold by the corresponding numbers of ewes.

Average fat and protein (nitrogen) annual contents have been estimated from the average of 2 or 3 analysis per month, multiplying them by their respective monthly milk quantity then dividing their sum by the annual milk yield. Due to uncertainty of data related to farm production of grain, the concentrate feed consumption was calculated only on purchased amounts. Sheep activity income is obtained by taking into account the sales of milk, lambs for slaughter, ewes and rams sold to other farmers. Variable expenditures are calculated by summing all feed and forage expenses, bedding, veterinary fees, mechanical repairs and maintenance expenses, fuel purchase, etc. Margins per ewe, per ha and per MPU were calculated by deducting the variable expenses from the sheep activity income. For farms that bred cattle or goats together with sheep the relative importance of sheep activity on the total (expressed in cattle units) was used to weight common expenses. Differently, the feed expenses and sheep product sales were always recorded apart.

Description of production systems

The productive objectives of the analysed flocks were milk and meat production. Milk is mostly (95%) sold to industry and processed into different Pecorino cheeses. Typical meat products are milk lambs slaughtered at about one month and around 10 kg of liveweight. Sarda is the only sheep breed that could be found over the 99% of Sardinian flocks.

In Table 1 means and ranges of variation of the most relevant technical figures are presented. According to the analyses previously performed on 1996-1998 data (ARAS, 1997; ARAS, 1999a; ARAS, 1999b; Ligios *et al.,* 1998; Natale *et al.,* 1998), the average flock was composed by 280 ewes with a replacement rate of 20% and exploited 60 ha of effective forage surface. The number of ewes managed by each manpower unit (187 ewes) was consistent with the group size often described for hand or machine milking activities (Casu, 1970), confirming this operation as the actual constraint in dairy sheep farming.

As frequently found in Mediterranean dairy sheep systems, lambings occurred in November-December for adult ewes and in January-March for ewe lambs. According to Flock-Book reproductive figures, adult ewes showed a 91% fertility (74% before January), whilst on ewe lambs a 74% fertility was recorded.

Table 1. Mean, coefficient of variation, minimum and maximum for technical indexes

Variable	N	Mean	CV	Minimum	Maximum
Total ewe number (ewe nb)	772	276.52	62.39	18	1201
Ewe lamb number	772	56.33	77.67	0	300
Replacement rate	772	20.26	42.76	0	67
Yearling number	772	52.73	75.99	0	350
Effective forage surface (ha)	772	59.57	73.67	1	390
Man power units (MPU)	466	1.54	47.65	1	6
Ewe nb/MPU	466	186.57	48.24	21	694
Fertility ewes >1 year, <1 Jan. (%)	772	73.55	21.33	0	100
Fertility ewes >1 year (%)	772	90.54	9.14	47	102
Ewe lamb fertility (%)	772	71.96	33.48	0	100
Flock litter size	772	1.21	10.36	1.00	1.83
Litter size ewes >1 year	772	1.24	11.24	1.00	1.92
Ewe lamb litter size	743	1.06	11.19	1.00	1.94
Lamb mortality (%)	772	4.30	94.08	0	46
Numerical productivity	770	1.06	16.42	0.51	1.89
Milked ewes/ewe nb (%)	767	65.35	15.55	13	99
Milked ewes/lambed ewes (%)	766	74.58	11.75	39	98
Flock milking period (days)	772	235.63	9.92	121	342
Milked production/ewe nb (l)	772	124.59	29.84	44.78	279.11
Milked production/lambed ewes (l)	772	142.07	26.90	56.07	306.34
Milked production/milked ewes (l)	772	190.10	25.14	73.68	355.97
Daily yield over milking period (l)	772	0.81	22.02	0.37	1.61
Fat content (%)	529	6.56	5.48	5.01	8.08
Protein content (%) (N x 6.38)	529	5.82	3.41	5.19	6.95
Concentrate feed/milked ewe/year (kg)	591	148.71	50.77	1.10	394.30
Concentrate feed/ewe nb/year (kg)	591	97.00	53.14	0.60	292.00
Concentrate feed/milked litre (kg)	591	0.82	55.57	0.01	3.40

As expected, the milk yield per lambed ewe, 142 litres, was lower than that recorded within the Flock-Book (about 190 litres in 148 days of milking). Nevertheless, average yield per ewe was consistent to that achievable from official statistic figures (ISTAT, 1990). According to milk yield figures, the milk contents recorded on the present sample were higher than those usually found within the Flock Book. Concentrate consumption per milk litre, obtained by dividing the purchased amounts by the milk sold, included not only concentrates used during the lactation on lambed ewes but also the amount used to feed the whole flock in the dry season and to raise the replacement lambs.

In Table 2 some economic indexes are reported. The ratio between milk sales and all sheep product sales (milk specialization index) was 71%, lower than that found in previous analyses (ARAS, 1999b). This result was predictable according to the recent drop of milk price. Indeed, the 71% ratio did not reveal an increased value of lamb production in Sardinian sheep farm, still very low (4.3 Euro per kg), but only the decreased value of milk sold. This fact could also explain the existence of negative margins for farms that did not accommodate rapidly their expenses to the expected sheep activity sales. As a matter of fact, in Sardinia only a quota of the milk price is paid off month by month and the residue is refunded at the end of the productive season.

Although in 1997, some industries used a milk price adjusted by microbial count and by fat and protein contents; these possible differences were not considered in the current study, as their importance was still low in the regional context.

Several facts reported in Table 1 and 2 showed a clear similitude between Sardinian and others dairy sheep production systems. From the flock structure to the ratio of variable expenses per ewe and per year, the description of Sarda farming systems seemed quite similar to that reported by Gabiña *et al.* (this volume) for Latxa flocks. Nevertheless, the comparison on milk and meat value revealed some differences that influenced heavily the sheep activity margin per ewe.

Table 2. Mean, coefficient of variation, minimum and maximum for economic indexes

Variable	N	Mean	CV	Minimum	Maximum
Variable expenses/ewe/year (Euros)	576	51.46	71.20	3.78	386.73
Feed expenses/ewe/year (Euros)	576	27.11	66.36	0.04	158.53
Feed/total expenses (%)	576	58.35	48.18	0.19	100.00
Milk sales (Euros) (a†)	772	20843	77.05	1457	146359
Milk sold (l)	772	35093	77.05	2454	246426
Milk price (Euros/litre)	772	0.59	0	0.59	0.59
Lamb sales (Euros) (c†)	768	6284	67.76	403	32800
Average lamb price (Euros/kg)	768	4.31	8.79	2.60	5.39
Sheep activity sales (Euros)	772	28829	72.40	2504	168518
Milk specialization† (%)	768	71.26	10.09	11.25	86.85
Subsidies/ewe (Euros)	541	22.44	68.64	1.91	141.50
Sheep activity margin/ewe (Euros)	550	54.99	50.25	–20.55	140.57
Sheep activity margin/ha (Euros)	550	312.74	77.27	–93.09	1637.36
Sheep activity margin/MPU (Euros)	356	10014	68.58	–2979	45775

†Milk specialization = a / (a+c).

Relationship between economic results and technical indexes

Correlation (Table 3) and regression analyses (Table 4) clearly showed that the milk yield per ewe is by far the most important trait that influence the cash surplus and revenue of the Sardinian dairy sheep farms. This result strongly support the choice of the milk yield at the milking period only as the selection criterion for genetic improvement of Sarda sheep. Thus, it validated that the current selection goal by improving the animal capability can increase, or at least sustain in presence of lower market prices, the economic margins of Sardinian dairy sheep farms.

Table 3. Correlations between margins and concentrate consumption with reproductive and milk production traits

Traits	Sheep activity margin			Concentrate consumption		
	Ewe	Ha	MPU	Ewe	Milked ewe	Milk litter
Fertility ewes >1 year, <1 Jan. (%)	0.20***	0.09*	0.06	0.14***	0.01	–0.03
Ewe lamb fertility (%)	0.23***	0.15***	0.12*	0.16***	0.10*	0.02
Fertility ewes >1 year (%)	0.23***	0.15***	0.12*	0.15***	0.01	–0.03
Flock litter size	0.31***	0.23***	–0.01	0.01	–0.07	–0.19***
Milked production/lambed ewes (l)	0.54***	0.46***	0.33***	0.17***	0.09*	–0.31***
Milked production/milked ewes (l)	0.54***	0.49***	0.41***	0.13**	0.13**	–0.31*
Fat content (%)	0.07	0.08	–0.03	–0.04	–0.11*	–0.04
Protein content (%) (N x 6.38)	0.01	0.02	0.01	–0.13**	–0.15**	–0.08

*P<0.05; **P<0.01; ***P<0.001.

Fertility and litter size revealed their substantial contribution to ensure satisfactory economic results but with a lower effect than milk yield. The negative regression coefficients, found for percentage of adult ewes lambed before the 1st January, both on margin per ewe and per ha, and also that for litter size on margin per MPU, need further analyses in order to check the effect of grouping of lambings and of increased litter size on winter feed expenses or on manpower costs.

Moreover, the null influence of fat and protein contents on margins, obtained neglecting any price supplement for milk composition, would require further analyses to verify their importance and their possible introduction as selection criteria.

Table 4. Results of the regressions of reproductive and milk production criteria on the margins by stepwise procedures

Variable	Partial R^2	Total R^2	Regression coeff. ± std. error
	Sheep activity margin/ewe		
1) Milked production/lambed ewes (l)	0.293***	0.293	0.38 ± 0.03†
2) Fertility ewes >1 year (%)	0.044***	0.338	0.64 ± 0.13††
3) Ewe lamb fertility (%)	0.015***	0.352	0.15 ± 0.04††
4) Flock litter size	0.010**	0.362	27.99 ± 8.71†††
5) Fertility ewes >1 year, <1 Jan. (%)	0.003	0.365	–0.11 ± 0.07††
	Sheep activity margin/ha		
1) Milked production/lambed ewes (l)	0.208***	0.208	2.92 ± 0.27†
2) Fertility ewes >1 year (%)	0.019***	0.226	4.67 ± 1.24††
3) Ewe lamb fertility (%)	0.005	0.231	0.88 ± 0.38††
4) Fertility ewes >1 year, < 1 Jan. (%)	0.006*	0.237	–1.83 ± 0.70††
5) Flock litter size	0.007*	0.244	187.63 ± 83.17†††
	Sheep activity margin/MPU		
1) Milked production/lambed ewes (l)	0.111***	0.111	77.57 ± 10.48†
2) Flock litter size	0.019**	0.129	–10458 ± 3187†††
3) Fertility ewes >1 year (%)	0.019**	0.148	122.34 ± 43.30††

†Euros/litter; ††Euros/%; †††Euros/lamb.
*P<0.05; **P<0.01; ***P<0.001.

Acknowledgements

Authors are in debt with all the advisors of the ARAS who participate to PERSEO program, whose accurate work made this study possible.

References

ARAS (1997). PERSEO. *Annuario 1996,* p. 130.
ARAS (1999a). PERSEO. *Annuario 1997*, p. 104.
ARAS (1999b). PERSEO. *Annuario 1998* (to be published).
Casu, S. (1970). La mungitura meccanica delle pecore. In: *Proceedings of the meeting on "Problemi degli Allevamenti Ovini e Bovini in Sardegna",* Bonassai (SS), 9-10 giugno 1970, 7-32.
Istituto Nazionale di Statistica (ISTAT) (1991). *IV Censimento Generale dell'Agricoltura*. Edn. ISTAT, Rome, Italy, 1990, pp. 203.
Ligios, S., Natale, M.A., Oppia, P., Bucarelli, G. and Casu, S. (1998). Influenza di alcuni fattori produttivi sui risultati tecnici ed economici degli allevamenti ovini sardi. *Relazione IZCS-ARAS,* p. 6.
Natale, M.A. (1996). PERSEO. Programma di elaborazione dati regionale e simulazione economica ovicaprini. In: *Proceedings XII Congr. SIPAOC*, 27-30.
Natale, M.A., Ligios, S., Oppia, P., Bucarelli, G. and Casu, S., (1998). Analisi economica sugli allevamenti ovini sardi nell'annata '95-'96. In: *Proceedings XIII Congr. SIPAOC*, p. 121.