
Small ruminant breeding programmes in Greece

A. Georgoudis & C. Ligda

Aristotle University, Faculty of Agriculture,
Dept. of Animal Science, GR-540 06 Thessaloniki, Greece

Small ruminant husbandry is the most important branch of the Greek animal production, contributing about 49 percent of the total output of animal production. In Greece about 9.2 million sheep and 5.9 million goats, which correspond to 50 percent of the total goat population of the European Union, are raised (Loukeri, 1996).

As the majority of sheep and goats are raised in mountainous and marginal regions of Greece, the productivity of these animals is low. However, in these regions sheep and goat production plays a substantial economic, social and ecological role by keeping the remaining inhabitants in the villages and contributing to the conservation of the environment (Boyazoglu, 1999).

The species involved are sheep and goats. The evolution and distribution of the different types and breeds of sheep in Greece are the result of developments and changes that have taken place over the past thirty years. The uncontrolled cross-breeding between the different breeds and the unplanned extension of artificial insemination have played a major role in the disappearance of certain smaller breeds and in the diminishing number of the pure-bred mountain populations. The major segment of the sheep population in Greece belongs to the Zackel type, which is found all over the country and is characterised by the long tail and the coarse wool. A second group is the Ruda type, mainly found in Macedonia, Thrace and on some Aegean islands and characterised by finer and more uniform wool. A third group consists of the semi-fat-tailed type found on East Aegean islands (Hatziminaoglou *et al.*, 1985; Boyazoglu, 1991; Zervas *et al.*, 1991).

The great majority (90 percent) of the goat population belongs to the various indigenous types, which are characterised by a strong constitution, good fertility with a relatively lower milk production and low reproduction

Introduction

Description and analysis of existing breeding programmes

Species involved

capacity. The local goat breeds represent today about 4.5 million animals in 200 000 herds. Among the different varieties of the local breeds, Skopelos is attracting the most attention. A small percentage of the population consists of pure-bred imported goat breeds such as Malta, Zaanen, Toggenburg and Damascus breeds and their crosses with the local animals (Hatziminaoglu *et al.*, 1985 and 1995).

The breeds involved

Genetic improvement programmes are applied to the following sheep breeds:

- mountain breeds: Boutsiko, Sfakia;
- plain breeds: Karagouniko, Serres, Frisarta; and
- island breeds: Chios, Lesvos, Kefallinias and Zakynthos.

As far as the goats are concerned, a genetic improvement programme is established for the local Skopelos breed.

Approximate overall input level of the production environment of the production system

Seventy eight per cent of sheep and 91 percent of goats are raised in low input production system in the mountainous and marginal regions of the country. These species, which are naturally adapted to the optimal use of poor and marginal regions in difficult grazing conditions, play a major role in the rural economy of these regions (Loukeri, 1996).

The sheep population in Greece is characterised by a great variability in husbandry practices. Sixty per cent of all flocks contain 1-50 ewes indicating that sheep raising is of complementary importance to other agricultural production branches.

The main production systems are the:

- extensive system with transhumance, which is applied to the mountain breeds Boutsiko and Sfakia;
- extensive or semi-intensive system without transhumance, which occasionally involves the Boutsiko and Sfakia breeds, the plain breeds, Karagouniko, Serres and Frisarta and occasionally the island breeds Chios, Lesvos, Zakynthos and Kefallinias; and
- intensive system which mainly concerns the Chios, Lesvos, Zakynthos and Kefallinias breeds and occasionally the Karagouniko, Serres and Frisarta breeds.

Very extensive husbandry systems with or without transhumance are applied to the local goat breeds, usually raised in the regions of the country where existing conditions prohibit sheep husbandry. The local Skopelos breed is kept in a semi intensive and intensive system (Ligda *et al.*, 1997; Georgoudis and Baltas, 1998).

The total number of flocks and animals recorded in each of the above-mentioned breeds is presented in table 1.

**Approximate
number of animals
concerned**

Table 1. Sheep and goat milk recording in Greece: Populations, number of recorded animals and herds.

Species and breeds	Total population	Recorded animals (Percent recorded)	Total flocks / herds	Recorded flocks / herds (Percent recorded)
Sheep breeds* (1999 data)	535 800	54 112 (pure-bred)	8 645	657 (6.2%)
		56 798 (total)		677 (7.8%)
Mountains of Epirus (Boutsiko)	10 000	1 380 (13.8%)	300	10 (3.3%)
Sfakia	73 000	6 780 (9.3%)	1 050	64 (6.1%)
Karagouniko	200 000	15 467 (7.7%)	3 210	278 (8.7%)
Serres	38 000	6 636 (17.5%)	670	66 (9.9%)
Frisarta	27 800	6 380 (22.9%)	835	80 (9.6%)
Chios (pure-bred)	<7 000	5 398 (77.1%)	350	45 (12.9%)
Chios (up-graded)	100 000	2 686		20
Lesvos	180 000	9 982 (5.6%)	2 230	94 (4.2%)
Kefallinias		1 550		11
Zakynthos		639		9
Goat breed**		8 357		103
Skopelos (data from 1999)	7 000	4 347 (62%)		45
Local		3700		46
Zaanen		646		7
Alpine		657		6

Improvement is targeting the entire breed or only a sector

The genetic improvement targets only the sectors of the breeds, which are being performance recorded. A specific plan for the dissemination of the improved genetic material to the rest of the population has not yet been initiated.

Approach through which the breeding goal was established

The total population of ewes and goats in the country is milked and about 90 percent of this milk is transformed into good to high quality cheeses. The average prices of ewe and goat milk are higher than that of cow milk. The relative values are 40-70 percent and 35-50 percent higher than the price of cow milk for ewe and goat milk, respectively (Table 2). On average 60 percent of the total income comes from milk production and 40 percent from lamb or kid meat production, which in Greece are traditionally slaughtered at a liveweight not above 14 kg. Taking into account the above parameters, the breeding objective was defined as the improvement of milk production and as having lamb / kid as a by-product.

Table 2. Milk marketing for small ruminants (adapted from F. Vallerand, 1997).

Market prices of milk	Cow	Ewe	Goat
Milk composition			
% fat + proteins	7.8	11.0	7.5
Index	100	140	95
Relative prices	100	200-250	130-150
Comparative Advantage	0	40-70%	35-50%

The plan designed and the plan actually followed

To meet the above-mentioned breeding goal, pure-breeding programmes for sheep and goats were introduced with mass selection based on individual identification of the animals and milk recording. The selected males are used mainly by the farmers for the up-grading of their flocks and a part of them are sold as breeding animals to other farmers inside and outside of the recorded population. This programme is applied in general to all breeds being milk recorded. In addition a promising target was set up concerning the application of a progeny-testing programme for the Karagouniko sheep breed. An attempt was also made for the establishment of a progeny-testing scheme for the Skopelos goat.

The breeding programme for the Karagouniko sheep breed included a nucleus of 18 000 ewes raised in 270 private flocks. The total population of the breed in the plains of West Thessaly is about 200 000 animals. The relevant Animal Genetic Improvement Centre collects the milk recording data for further processing. By the end of the lactation period, information on the total milk production of the flock and of each ewe separately is provided to the farmers who can make decisions regarding the culling of

the animals and the renewal of their flock. Using mass selected and progeny tested rams as described in the following description, the farmers produce the replacement lambs for their flock.

A number of rams selected from the superior ewes (based on milk production) from the best flocks of the nucleus are performance tested in a progeny-testing scheme that was initiated in 1986. The best four or five controlled rams, selected on their daughters' performance, are used in planned matings with exceptional ewes. The rest rams that are not selected remain in the Artificial Insemination Centre for two more years and their semen is used for the fertilisation of low or medium producing ewes (Georgoudis *et al.*, 1995).

A similar scheme was designed in 1990-1993 for the Skopelos goat breed but some major difficulties interrupted the attempt.

The breeding programme applied to the Frisarta sheep that is referring to 6 380 ewes, includes the selection of the rams on their dam performance and their body conformation. The females for replacement are selected based on their dam milk production and their own records.

A different approach is followed for the Chios sheep breed where an attempt is made to establish a pyramidal selection scheme with multi-trait selection in the nucleus. The nucleus includes 500 Chios ewes raised in the Agricultural Research Station in Chalkidiki where, a rotational mating system to avoid inbreeding has been applied since 1980 (average rate of inbreeding: 0.013) (Gabriilidis *et al.*, 1996). The following traits are included in the breeding goal: commercial milk production, litter size and average litter weight at weaning. The rams are used in the nucleus for only one mating period and every year are selected on the total merit index. During the next period the rams together with male lambs are sold for the up-grading of the commercial flocks (Ligda, 1999).

The goals set up in the initial phases of the genetic improvement programme were proven to be too ambitious, as problems concerning financial and human resources were not taken into consideration at first.

At what stage did the diversion occur?

For all breeds the breeding goal is the same and consists of commercial milk production. Economic studies that were carried out were used as general directions for the definition of breeding objectives.

Breeding goal

In the nucleus flock of the Chios breed in the Agricultural Research Station of Chalkidiki, multi-trait selection is applied. The traits included in the breeding goal are the commercial milk production, litter size and average litter weight at weaning.

Selection criteria

In all existing breeding programmes, the selection criterion is the total commercial milk yield of the animals, which corresponds to the total amount of milk produced after weaning of the lambs / kids at 42 / 60 days, respectively.

The selection in the nucleus flock of the Agricultural Research Station of Chalkidiki is based on the total genetic merit calculated by the application of a multi-trait animal model, which includes commercial milk production, litter size and average litter weight at weaning (Ligda, 1999).

Dissemination of improved males and/or females

As it was mentioned previously, the dissemination of the improved genetic material is realised by selling males and / or females directly by the farmers. The Ministry of Agriculture through the Genetic Improvement Centres occasionally supports this. The Agricultural Research Station of Chalkidiki of the National Agricultural Research Foundation, sells rams and young males and females to the farmers with pedigrees, approved by the Ministry of Agriculture.

Breeding structure

The breeding system applied is pure-breeding (straight-breeding). The size of the nucleus flocks being milk recorded was simply determined by the available financial and human resources. The application of a three-tier pyramidal selection scheme for the Chios sheep is being developed.

Farmer and Government involvement

The organizations involved in the on-farm performance recording are: The Ministry of Agriculture, Directorate for Inputs to Animal Production with five regional Animal Genetic Improvement Centres and the recently established Breeders' Associations, which will be subsidised by the Ministry of Agriculture until 2006. Performance recording on the Agricultural Research Stations is supervised by the National Foundation for Agricultural Research, which indirectly receives financial support from the Ministry of Agriculture (Baltas, 1995; Georgoudis and Baltas, 1998).

Technical support

The technical support to the breeding programme is provided by the Ministry of Agriculture, the regional Animal Genetic Improvement Centres and specialised scientific personnel employed by the Breeders' Associations. The country's agricultural universities support the scheme with computer facilities, software for processing the collected data and scientific methodology for the genetic evaluation of the recorded populations.

The main reason for introducing and maintaining the scheme was the improvement of milk production of the local breeds. The authorities of the country also use the data collected for planning their activities.

**Reasons for
introducing
the scheme**

The Ministry of Agriculture is in charge of the organization and operation of milk recording and herd bookkeeping, but it is intended to totally involve the newly established cooperative organizations, under the supervision of the Ministry (Baltas, 1995).

**Significant
activities
initiated**

Recently, milk recording has been carried out more systematically on a larger scale and within the framework of a more specific genetic improvement programme per animal species and breed. A number of milk recorders have been employed, but they were not enough to cover the needs of the milk recording programme. Furthermore, close cooperation has been established between the competent services of the Ministry of Agriculture and the country's agricultural universities.

**Significant
activities
maintained**

The direct involvement of breeder associations or farmer organizations in performance recording and in maintaining the breeding programme is necessary for the secure and continuing implementation of the programme. Such an involvement pre-supposes the increase of the support and services provided to the farmers, otherwise the farmers will have no motivation to participate in such an organization. To date, the feedback to the farmers has consisted of information on milk recording and some information on the lambings (number of lambs born). However, it is important to extend the data collected to information on reproduction traits, economic indexes, health and functional traits, in order to use this information on the management, feeding and health care of the flocks.

**What changes
should be
made?**

It is also important that the computer output is clear and the farmers can understand and interpret the results for the benefit of their flocks.

Changes in the traits included in the breeding goal have to be considered. Some traits to be studied are milk composition, somatic cell count and udder morphology. The redefinition, after extensive study of the production and marketing system of the breeding objectives, which may not be the same for all the breeds concerned, is necessary.

The farmers should financially contribute to the milk recording programme, in contrast with the previous periods when the Ministry of Agriculture granted them considerable premiums to join the recording and genetic improvement scheme, in order to prove that the previous changes regarding the kind of support and information to farmers should be established.

**Future
directions**

Research is also directed to the introduction of simplified recording methods to reduce the cost of milk recording. Another objective is the application of pyramidal selection schemes with breeding nucleus for specific breeds.

Estimates of genetic change

Results from the application of the multi-trait animal model in the nucleus of the Chios breed showed an annual genetic improvement of 2.9 kg of milk yield per lactation, 0.3 lambs per 100 lambings and a slight decrease of the average litter weight of 3 g, which is counterbalanced by the increase in litter size (Ligda, 1999).

Estimates of genetic change due to the application of the breeding programme are not available because of the lack of information concerning the ancestors of the animals. However, from the results of the Genetic Improvement programme, the milk production of the Karagouniko breed, has reached 167 kg, an increase from 121 kg at the beginning of the implementation of the programme. The average milk production of regularly controlled Frisarta ewes, during the years 1990-93, is 220 kg (Ministry of Agriculture, 1995; 1997a). The milk yield of the Boutsiko breed, in the Research Station in Ioannina increased to 150 kg from 100 kg, after selection had been applied in the Station (NAGREF, 1996). Results concerning the milk production of eight Skopelos goat herds that have participated continuously in the National Genetic Improvement Programme for at least nine years, showed an increase in milk yield from 240 kg to 340 kg (Ministry of Agriculture, 1997b).

Conclusions

Summarising the experiences gained during the period of the application of the Genetic Improvement Programme for small ruminants in Greece, the following can be concluded, from the technical, operational and policy points:

Technical

The projects have been implemented without detailed technical description and clear breeding goals. There was no specific plan for the dissemination of the improved genetic material. The technical and financial support offered by the Ministry of Agriculture was not in accordance with the demands of projects of such dimensions.

Operational

The implementation of the projects were interrupted several times because of lack of finance, which mostly inhibited the ability to hire personnel for milk recording. The collaboration with farmer organizations and breeder associations has only recently been established. Moreover, the collaboration with the Artificial Insemination Services was poor.

There was no specific plan for the genetic improvement of the local breeds by pure-breeding. For many years the introduction of many foreign breeds for the improvement of the local population was supported, which in conjunction with the extended cross-breeding between the local breeds, resulted in extended and undefined cross-breeds.

Policy

Baltas, A. 1995. Current situation, problems and perspectives of Animal Performance Recording in Greece. Proceedings of the Symposium on Animal Performance Recording, Thessaloniki, Greece (in print).

References

Boyazoglu, J.G. 1991. Milk breeds of sheep. In Genetic Resources of Pig, Sheep and Goat, Maijala, K. (ed.). Elsevier Science Publishers B.V., Amsterdam, Chapter 13, pp. 243-255.

Boyazoglu, J.G. 1999. Livestock production systems and local animal genetic resources with special reference to the Mediterranean region. VII Congress of the Mediterranean Federation for Ruminant Health and Production. Santarem, Portugal.

Gabriilidis, G. Th. Papadopoulos & M. Kiorpelidou. 1996. Results from the application of a rotational mating system in the management of a closed sheep nucleus. *Animal Science Review*, Special Issue, 14: 23-24 (Greek).

Georgoudis, A.J. Hatziminaoglou & V. Pappas. 1995. The breeding scheme of the Karagouniko sheep in Greece. Strategies for sheep and goat breeding. *Cahiers Options Méditerranéennes*, Vol. 11: 61-65.

Georgoudis, A. & A. Baltas. 1998. The development and maintenance of animal recording systems in Greece: A case study. *Animal Genetic Resources Information*, No 23: 27-40.

Hatziminaoglou J., N. Zervas & J.G. Boyazoglu. 1985. Sheep and Goat in Greece (in Greek and English). Special publication of the University of Thessaloniki, pp. 25.

Hatziminaoglou J., N. Zervas & J.G. Boyazoglu. 1995. Goat production systems in the Mediterranean area: the case of Greece. EAAP publication No 71: 82-109.

Ligda, Ch. 1999. Genetic evaluation of Chios sheep using a multi-trait animal model. Ph.D. Thesis. Aristotle University of Thessaloniki. Greece. (Greek with English abstract).

Ligda, Ch., A. Baltas, A. Georgoudis, J. Hatziminaoglou & J.G. Boyazoglu. 1997. The organization of sheep and goat breeding in Greece. Sheep and Goat Husbandry in Central and Eastern European Countries. International Workshop. Hungary, pp.122-126.

Loukeri, A. 1996. The Greek sheep and goat husbandry in the frame of the European Union and GATT. *Animal Science Review*, Special Edition, 18: 13-19 (Greek).

Ministry of Agriculture. 1995. Annual Report of the Animal Genetic Improvement Centre of Ioannina (Greek).

Ministry of Agriculture. 1997a. Annual Report of the Animal Genetic Improvement Centre of Karditsa (Greek).

Ministry of Agriculture. 1997b. Annual Report of the Animal Genetic Improvement Centre of Karditsa (Greek).

NAGREF. 1996. Agricultural Research Station of Ioannina. The Boutsiko sheep breed (Greek).

Vallerand, F. 1997. Personal communication.

Zervas N., J. Hatziminaoglou, J.G. Boyazoglu & A. Georgoudis. 1991. Production Potential and Breeding Schemes of some Mediterranean Dairy Sheep Breeds. *FAO, Animal Genetic Resources Information No 8*, Rome, pp. 11-27.