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Considerations for the mixed production system in the Mediterranean area

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SUMMARY - The purpose of this paper is to review the main factors associated with particular circumstances of the mixed systems in the Mediterranean area and show how they affect the breeding and genetic improvement of the species producing red meat. The herds and flocks of farmers in settled areas with crop production are often small. In the cattle herds supplying milk to urban populations, meat is a secondary product. Sheep and goats are usually kept firstly for milk but with meat as an important second product. The main limitations on meat output from sheep are often the low litter size and lamb mortality. Goats, because of their physical constitution, are not the type of animals which are suitable for meat production. If this is a disadvantage, it is compensated by their higher prolificacy compared to the other ruminants. In the majority of the areas with mixed type of production and breeding systems, the adaptation to the local conditions will be of prime importance, while crossbreeding with exotic stock may not be successful in all environments. If crossbreeding is really desired by the herdsmen, first consideration should be given to the probability of crossing among different local breeds and not to crossing with exotic breeds. Where flocks and herds are small, selection by the individual farmer would be ineffective except for the elimination of unproductive animals. Co-operation among farmers and keeping some records would be essential.

Key words: Red meat, cattle, sheep, goats, breeding programmes.

RESUME - *"Considérations pour un système de production mixte dans la région Méditerranéenne". L'objectif de cette étude est de revoir les facteurs principaux associés à des circonstances particulières dominantes dans des systèmes mixtes de la région Méditerranéenne et de montrer la manière selon laquelle ils affectent l'élevage et l'amélioration génétique des espèces qui produisent de la viande rouge. Les troupeaux des animaux appartenant aux éleveurs dans des régions établies où des cultures existent, sont le plus souvent de petite taille. Dans les troupeaux de bovins produisant du lait destiné à être consommé par des populations urbaines, la viande est un produit secondaire. La production de lait constitue la raison principale pour laquelle les ovins et caprins sont élevés, tandis que la production de viande est de moindre importance. Les restrictions principales influençant la production de viande sont souvent la petite portée et la mortalité des agneaux. Les caprins, à cause de leur constitution physique, ne sont pas considérés propres à la production de viande, fait qui est compensé par la haute prolificité par comparaison avec d'autres ruminants. Dans la plupart des régions où est pratiquée la production de type mixte et des systèmes d'élevage, l'adaptation aux conditions locales serait de grande importance, alors que les croisements avec des animaux exotiques peuvent ne pas réussir dans tous les milieux. Si les éleveurs tiennent à appliquer des croisements, il faut que la première considération soit donnée à la probabilité de faire ces croisements parmi les différentes races locales et non pas avec des races exotiques. Dans les cas où les troupeaux d'animaux sont de petite taille, la sélection pratiquée par un éleveur individuel n'est pas efficace, sauf quand il s'agit d'écarter les animaux non productifs. On considère comme essentielles tant la coopération parmi les éleveurs que la tenue des registres.*

Mots-clés : *Viande rouge, bovins, ovins, caprins, programmes d'amélioration.*

Introduction

The area generally referred as the Mediterranean, is not a uniform one, including dry and hot regions, where the land is partitioned abruptly by mountains and where a great variety of ecosystems and local production systems with indigenous breeds are found (Zervas *et al.*, 1983).

The total number of bovines and buffaloes population found in the Mediterranean area (which includes the African, Asian and European Mediterranean regions), reaches 69 million heads,

representing 5.2% of the world population. This population produces 5,295 thousand tons of meat (including camels), representing 9.4% of the world production (Tables 1 and 2).

Table 1. Number of sheep and goats in the European Union in 1995 (1,000 tons)

Country	Sheep	Total population (%)	Goats	Total population (%)
Belgium	130	0.13	8	0.06
Denmark	87	0.09	-	-
Germany	2,369	2.40	91	0.74
Greece	10,069	10.25	5,821	47.47
Spain	23,836	24.26	2,793	23.00
Finland	75	0.07	5	0.04
France	10,453	10.64	1,055	8.65
Ireland	5,990	6.01	-	-
Italy	10,461	10.65	1,378	11.3
Luxembourg	7	0.007	1	0.008
Netherlands	1,300	1.32	66	0.54
Austria	334	0.34	47	0.38
Portugal	3,305	3.36	836	6.85
Sweden	471	0.48	4	0.03
United Kingdom	29,332	29.86	97	0.79
European Union	98,219	99.86	12,202	99.86

Dairy cattle are usually kept in relatively large herds supplying milk to urban populations, while the meat of calves and the culled cows considered as a secondary product. Males and heifers, which used as stock replacements are slaughtered 12-17 months and the cows at the end of their milk-producing life, on average between their 4^{th} and 5^{th} lactation. The mountainous ranch-type cattle production is the most concerned with meat output. Fattening herds are specialized in the production of beef, which goes for consumption for large urban populations (Boyazoglu, 1990).

Sheep and goats are the species naturally adapted to the optimal use of poor and marginal regions under difficult grazing conditions and consequently small ruminants are the main species of farm animals for the optimal utilization of marginal areas. Sheep and goats are usually kept first for milk, but with meat as an important second product (Boyazoglu, 1990).

The total number of the sheep and goat population found in the Mediterranean area, reaches 228 million heads, which represents the 13.3% of the world population. This population produces 1,783 thousand tons of mutton and lamb, representing 16.6% of the world production and about 50% of the total sheep and goat milk production. More than three quarters of this milk is produced in southern Europe (France, Portugal, Spain, Italy, Yugoslavia, Albania, Bulgaria and Greece). Production and consumption of sheep and goat products (meat, milk, wool and hides) in Europe are concentrated in the southern Mediterranean countries and the British Isles, whereas over 80% of the European sheep and goat population is found in eight countries (Tables 1 and 2).

It must be noticed that three-quarters of the sheep and about two-thirds of the goat populations of the Mediterranean region are, in fact, concentrated in the more fertile northern part of the basin. Sheep numbers are twice as high as those of cattle in this part of the world, while on a European and world scale, their numbers are practically identical.

Table 2. Milk production in Europe

Country	Production (1,000 tons)					Percentage			
	Cows	Ewes	Goats	Buffalo cows	Total	Cows	Ewes	Goats	Buffalo cows
Albania	316	45	40		401	78.8	11.2	10.0	0.0
Austria	3,360		10		3,370	99.7	0.0	0.3	0.0
Bulgaria	2,112	274	71	20	2,477	85.3	11.1	2.9	0.8
Czechoslovakia	6,931	44	19		6,994	99.1	0.6	0.3	0.0
France	26,000	187	460		26,647	97.6	0.7	1.7	0.0
Germany FR	23,725		22		23,747	99.9	0.0	0.1	0.0
Germany NL	9,100		15		9,115	99.8	0.0	0.2	0.0
Greece	670	650	460		1,780	37.6	36.5	25.8	0.0
Hungary	2,897	6	3		2,906	99.7	0.2	0.1	0.0
Italy	10,376	628	126	110	11,240	92.3	5.6	1.1	1.0
Malta	24	1	2		27	88.9	3.7	7.4	0.0
Norway	1,912		28		1,940	98.6	0.0	1.4	0.0
Poland	16,170	8			16,178	100.0	0.0	0.0	0.0
Portugal	1,544	85	42		1,671	92.4	5.1	2.5	0.0
Romania	4,400	360			4,760	92.4	7.6	0.0	0.0
Spain	6,100	270	430		6,800	89.7	4.0	6.3	0.0
Switzerland	3,772		20		3,792	99.5	0.0	0.5	0.0
Yugoslavia	4,500	148			4,648	96.8	3.2	0.0	0.0
Other European countries	46,990				46,990				
Total	170,899	2,706	1,748	130	175,483	97.4	1.5	1.0	0.1
World	475,507	8,395	8,427	38,500	530,829	89.6	1.6	1.6	7.3

The meat factor and the milk production

Sheep and goat husbandry in the Mediterranean is characterized by a rich variability in animal populations, as well as in environment and husbandry methods. The important role which small stock production (milk, meat, wool and hides), plays can be considered from the following points of view (Zervas *et al.*, 1983):

(i) From an economic point of view: the large rural areas with a lower production potential can be exploited.

(ii) From a cultural point of view: this production has long been, and still is, a traditional activity. In fact, it can be singled out as the most important activity of rural societies in the Mediterranean basin.

(iii) From an ecological and environmental point of view: there is a valuable interaction between the evolution of forestry and Mediterranean shrub.

In the agricultural activity of the Mediterranean basin the most important role of the sheep and goat production is the economic one, from which transhumant sheep and goat production has been and still is a common practice in many of these regions, where as nomadism still exists in northern Africa and Middle East. More than 60% of all ewes are milked totally or partially and about 90% of this milk is transformed into good to high quality cheeses. These cheeses are produced wholly or partly from sheep milk. Regarding the countries of the European Union, the average percentage of milked ewes reaches 29.2%, while two countries, Greece and Italy, milk 93.6% and 89.8% of the population, respectively. Three other countries, namely Spain, France and Portugal, milk 18.6%, 20.2% and 23.9% of the sheep population (Galal and Aboul-Naga, 1989), (Table 3).

Table 3. Percentage of milked ewes (% of the total population)

Country	Percentage of milked ewes (%)
Belgium	1.2
Denmark	1.4
Germany	0.4
Greece	93.6
Spain	18.6
France	20.2
Ireland	-
Italy	89.8
Luxembourg	-
Netherlands	-
Portugal	23.9
United Kingdom	0.05
European Union 12	29.2

In order to understand the Mediterranean sheep husbandry systems, a schematic comparison of the different suckling and milking systems applied in Europe is required (Fig. 1). The different milk control methods must also be considered, taking into account that most breeds, particularly in the northern part of the Mediterranean basin, are mainly used for milking (Table 3). The local genetic material, which can play a major role in the future, includes the following: the true "dairy sheep", namely the Awassi, Sarda, Chios, etc.; breeds where milk and meat are of equal importance (not to mention the importance of wool for the local carpet industry), such as the Churra, Karagouniko, Lacaune, Kivircik, Tsigai, Serra de Estrela, etc., and the local adaptable, hardy breeds with a low milk potential, but which are mostly currently and traditionally milked, such as the Manech, Vlahico,

Karayoka, as well as many of the fat-tailed sheep of northern Africa and the Middle East (Boyazoglu, 1991a), (Table 4).

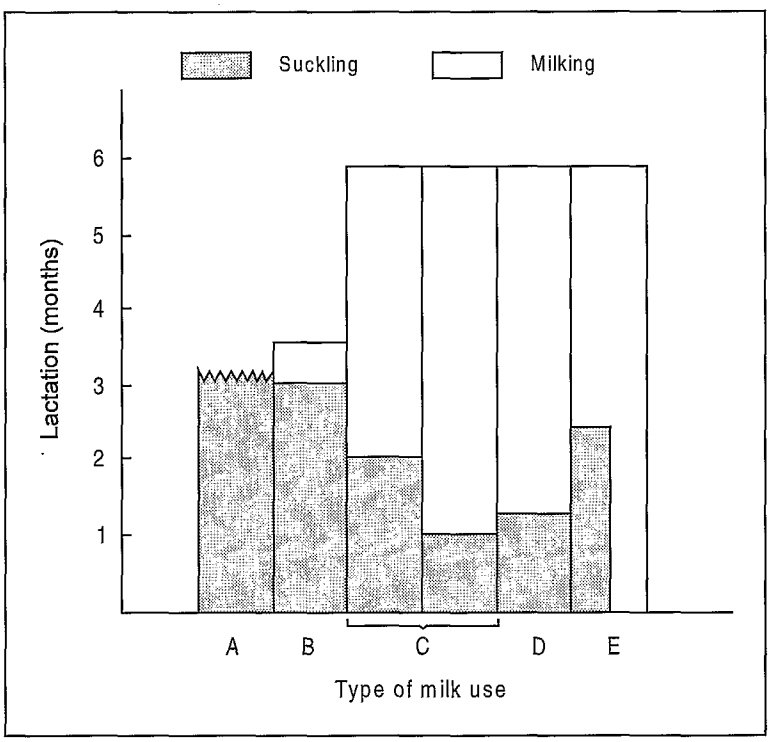

Fig. 1. The use of milk of individual ewes in Mediterranean dairy sheep systems (adapted from Boyazoglu, 1991a). A: Suckling ewes without milking; B: Suckling ewes with a short milking period (e.g., steppic flocks in North Africa and Merino types in the south-west of the Iberic Peninsula and north of the Balkans); C: Milking ewes with two types of milk use within the same flock (Greece, Italy, Spain, etc.): -after late weaning if lamb is kept for breeding -after early slaughtering of remaining lambs at 3-4 weeks; D: Milking ewes with early weaning of lambs at 4-5 weeks; E: Milking ewes, simultaneously milked and suckled during the 2-3 first months of lactation (e.g., Israel dairy flocks).

From the study of the market prices of milk from dairy cows and small ruminants (Table 5), it is obvious that the average price of ewes' milk is 40-70% higher than that of the cows' milk and also higher than that of the goats' milk which yields 35-50% higher than that of the cows' milk. The high prices of the ewes' milk result to a tendency for improving the milk production of the animals through better management and selection programmes and having the lamb as by-product. On average 60% of the total income comes from milk production and 40% from lamb meat production.

With respect to mutton and lamb, many of the Mediterranean countries traditionally produce milked lambs or young fattened lambs (e.g., Italy, Greece, Portugal, Tunisia, Morocco), with an average carcass weight of 9-12 kg. In other countries, mutton is preferred (e.g., Egypt, Algeria, Libya, Cyprus, Israel, Jordan, Lebanon). In some cases, both productions exist (e.g., France and Spain). Despite this diversity, there is, on average, a definite trend towards heavier carcasses of 15-20 kg. It must be mentioned that France and Italy are, strictly speaking, only partly "Mediterranean" in character. In fact, these countries can only be considered as "Mediterranean" with regard to about one third to half of their sheep and goat populations. The major sheep and goat countries (production and consumption) are Turkey, Greece, Bulgaria and the south eastern coast of the Mediterranean basin (Lebanon, Israel and Egypt). Spain and Portugal can be considered as intermediate cases (Galal and Aboul-Naga, 1989; Boyazoglu, 1990; Papachristoforou and Mavrogenis, 1994; Hatziminaoglou *et al.,* 1995).

Table 4. Classification of some of the milked breeds, mainly in the Mediterranean region (adapted from Boyazoglu, 1991a)

High potential	- Awassi (Israel) - Chios (Greece/Cyprus) - Lacaune (France) - Sarda (Italy)
Average to good potential	- Beglika (Bulgaria) - Bergamasca (Italy) - Churra (Spain) - Comisana (Italy) - Kymi/Skopelos (Greece) - Lacha (Spain) - Langhe (Italy) - Stara Zagora (Bulgaria) - Zlatoucha (Bulgaria)
Low potential	- Awassi (Turkey/Middle East countries) - Barbary (Tunisia/Libya) - Bordaleiro (Portugal) - Kivircik (Turkey) - Manchega (Spain) - Manech (France) - Mytilini (Greece) - Serra da Estrela (Portugal) - Serres (Greece) - Sopravissana (Italy) - Tzigaja (Yugoslavia/Bulgaria) - Vlahiko (Greece)

Table 5. 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%

Breeding schemes for the mixed production system

The area of the Mediterranean basin includes different environments, each of them requires a different emphasis on livestock breeding and improvement. However, the principles of genetic improvement apply to all species and characteristics of livestock and practical breeding plans have to be adapted to particular circumstances, depending on where and how the animals are kept, numbers, attributes and functions of each class of livestock and on the needs for the farmer. There are many combinations of these different circumstances and for each of them specific breeding plans are applied. In the following, the main factors associated with these circumstances are reviewed and it is pointed out how they affect the breeding and genetic improvement of the species producing red meat (Boyazoglu, 1990; Boyazoglu, 1991b; Astruc and Barillet, 1996).

The productivity of sheep and goat populations in this region will naturally, to a large extent, depend on the judicious and timely application of modern breeding and husbandry techniques. Considerable effort has to be made in the field of milk and meat controls, as well as in obtaining information on the other important qualities of the local breeds (e.g., prolificacy, breeding season, etc.). The introduction of modern milking and fattening techniques can solve important sociological problems and the more optimal use of expensive pastures and grazing will help minimize production costs. In relation to these efforts, the necessity of preserving and selecting many of the local populations of the Mediterranean, which have important specific productive genes must be stressed (Galal and Aboul-Naga, 1989; Gabiña, 1995).

The herds and flocks of pastoralists have reasonably large numbers of animals. Pastoralists nearly always have to rely entirely on the available natural herbage as feed for their livestock and it is difficult to improve on those conditions. The main limitation on meat output from sheep are often low litter size, high lamb mortality and infrequent reproduction. In general, the reproductive rate of goats is less limiting on breed improvement than it is for sheep. In some areas, migration of flocks and herds is restricted to certain times of the year, for example to exploit summer pastures at higher elevations or to follow the aftermath of crop harvests. This might alternate with more static periods for the animals in the neighbourhood of the villages. Such periodic migration can increase the overall feed supply to the animals (Zervas *et al.*, 1983; Alifakiotis, 1990; Hatziminaoglou *et al.*, 1995).

The herds and flocks of farmers in settled areas with crop production are most often small. The availability of crop by-products and other feed makes it reasonably to think of crossbreeding to produce more productive animals, even though they need more feed. Milk, meat and labour force Cattle are in rearing cropping areas is providing, while goats and sheep are mainly kept for both meat and milk, although the emphasis given to each product will differ from place to place. Deciding on the objectives for genetic improvement is, therefore, more difficult in this type of herd or flock than those where a single animal product provides the principal source of income. In the most of the areas, local adaptation will be of prime importance, while crossbreeding with exotic stock may not be successful in all environments. When selection within a local breed is the best option, the environment will influence the priorities to give to different traits. If crossbreeding is really wanted by the herders, considerations should be given to the probability of crossing among different local breeds and not to crossing with exotics (Zervas *et al.*, 1983; Galal and Aboul-Naga, 1989; Chevalier, 1992; Hatziminaoglou *et al.*, 1995).

With regard to purebreeding, it should be stressed that the variability of the Mediterranean environmental conditions as well as different social, economic and technical situations, do not favour the adoption of a single selection scheme. Appropriate schemes can range from pedigree and individual selection within nucleus-flocks, to various sophisticated large scale progeny testing programmes using Artificial Insemination and advanced methods of evaluation like BLUP and Animal Models. Programmes combining conventional progeny testing and MOET technology although interesting, are still under scrutiny (Barillet *et al.*, 1990; Zervas *et al.*, 1991).

When individual flocks and herds are small, selection by the individual farmer would be ineffective except for the elimination of unproductive animals. An option for genetically improving the existing local breeds would be to have central breeding studs to supply sires and rams or semen. Furthermore, co-operation of several flock owners for keeping some records would be a big advantage for progress from selection and also reduce the risks of inbreeding. For sheep and goats, larger body size, which is positively related to total meat output, would be a relatively simple trait for selection, but it has the disadvantage that larger animals may not be wanted because they need more feed. Other aspects of the same importance, such as regularity of breeding and good mothering ability of the females, good survival of the young, can be modified genetically only if good records are available and the selection continues over many years, i.e., below are shown some facts relevant to the selection scheme applied in the nucleus of the Chios breed in the Chalkidiki Research Station in northern Greece. Selection of female and male lambs is based on individual weaning weight and on dam's performance for milk production and litter size. Information on these traits is combined in a selection index and the relevant phenotypic and genetic parameters are shown in Tables 6 and 7 (Boyazoglu, 1991b; Georgoudis *et al.*, 1997).

The multi-purpose use of cattle makes it particularly important to pay more attention to the trait which gives the greatest improvement in economic terms. This applies to improvement schemes both

by selection and crossbreeding. In many situations economic priority will be given to increase milk production, but this can differ greatly between herds and areas. Even in the relatively large herds supplying milk to urban populations, meat cannot be ignored because males are slaughtered, so the cows at the end of their milk-producing life. In ranch type cattle production, which is mostly concerned with meat output, milk often provides a useful source of food for the owners, workers and families (Boyazoglu, 1990; Chevalier, 1992).

Table 6. Selection index applied in the Chios nucleus flock. Estimates of heritabilities, genetic and phenotypic correlations among traits used in selection index

Traits	Commercial milk yield	Litter size	Weaning weight
Commercial milk yield	0.23	0.13	0.05
Litter size	0.08	0.16	-0.39
Weaning weight	0.01	-0.06	0.17

Table 7. Direct and maternal heritabilities for weaning weight of Chios lambs

Direct heritability	h_d^2	0.17
Maternal heritability	m^2	0.07
Genetic covariance between direct and maternal genetic effects/total variance	c_{am}	-0.03
Genetic correlation	r_{am}	-0.26
Permanent environmental variance due to dam/phenotypic variance	c^2	0.08
Total heritability	h_T^2	0.17

The total number of herds or flocks specialized in the production of meat for large urban populations may be of small size in relation to the vast livestock populations of the Mediterranean basin, but the opportunities for genetic improvement are considerable. Most of these units have relatively large numbers of animals. Management is often better and feed supply less erratic than in some other situations. Both selection and crossbreeding can be appropriate options, in this type of herds and flocks, one aspect of production, milk or meat, is usually much more important than the other. This simplifies the breeding objectives (Boyazoglu, 1990; Boyazoglu, 1991b; Hatziminaoglou *et al.*, 1995; Astruc and Barillet, 1996).

The general agro-economic evolution of the Mediterranean basin countries must basically follow these lines. However, the question arises whether the intensification of production will be, as in the case of cattle, accompanied by a generalized homogenization of the animal genetic material to the benefit of one single breed; or whether, as is hoped, the diversity of the breeds in the Mediterranean basin, which constitutes a specific coefficient and an important reservoir of genes in this area, will be exploited to the optimum. With regard to the available animal material, the potential and performance of local populations should thoroughly understood. Furthermore, a sound evaluation of the use of these genotypes is essential (Gabiña, 1995; Georgoudis, 1995).

References

Alifakiotis, T.A. (1990). Characteristics and management of reproduction of small ruminants in Mediterranean countries. In: *Proc. Intern. Symp. for the Livestock in the Mediterranean Cereal Production Systems,* Rabat, Morocco.

Astruc, J.M. and Barillet, F. (1996). Report of the working group on milk recording of sheep: Survey of milk recording and genetic evaluation in dairy sheep. In: *Proc. 30th ICAR Conference*, Veldhoven, The Netherlands.

Barillet, F., Boichard, D., Barbat, A., Astruc, J.M. and Bonaiti, B. (1990). Use of animal model for genetic evaluation of dairy sheep. In: *Proc. 41st Annual Meeting of the EAAP,* Toulouse, France.

Boyazoglu, J.G. (1990). Animal agriculture with special reference to Europe and the Mediterranean basin. A view to the future. *Produzione Animale,* 3, III Serie, 109-130.

Boyazoglu, J.G. (1991a). 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. (1991b). Milk recording, breeding and selection schemes for milk breeds. In: *Genetic Resources of Pig, Sheep and Goat,* Maijala, K. (ed.). Elsevier Science Publishers B.V., Amsterdam, Chapter 18, pp. 327-336.

Chevalier, C. (1992). Bases d'une approche des systèmes d'elevage mixte lait-viande fondés sur une race mixte: le cas de la Pie Rouge de l'est. In: *Agriculture - Programme de recherche Agrimed, Approche globale des systèmes d'élevage et étude de leurs niveaux d'organisation: concepts, méthodes et résultats.* Commission des Communautés européennes, EUR 14479, pp. 131-138.

Gabiña, D. (1995). Current state of Mediterranean small ruminant germplasm and its characterization. In: *Proc. Intern. Symp. on Mediterranean Animal Germplasm and Future Human Challenges,* Benevento, Italy.

Galal, E.S.E. and Aboul-Naga, M. (1989). Utilization of native small ruminant breeds. In: *Proc. Intern. Symp. on the Constraints and Possibilities of Ruminant Production in the Dry Subtropics,* Cairo, Egypt.

Georgoudis, A. (1995). Animal genetic diversity plays important role in Mediterranean agriculture. *Diversity: The Mediterranean*, 11, No. 1-2: 16-19.

Georgoudis, A.G., Ligda, Ch., Gabriilidis, G.H. and Papadopoulos, Th. (1997). Prediction of the lactation yield in dairy sheep using a test-day animal model, electronic identification of animals and automated data collection. In: *Proc. Subnetwork on Animal Resources, FAO-CIHEAM Network of Cooperative Research on Sheep and Goats,* 9-11 March 1997, Toulouse, France.

Hatziminaoglou, J., Zervas, N.P. and Boyazoglu, J. (1995*). Goat production systems in the Mediterranean area: The case of Greece,* EAAP Publication, No. 71, pp. 82-109.

Papachristoforou, C. and Mavrogenis, A.P. (1994). Milk and meat from a native Cyprus goat under an extensive production system. In: *Proc. Inter. Symp. on the Exploitation of Marginal Mediterranean Areas by Extensive Ruminant Production,* Thessaloniki, Greece.

Vallerand, F. (1997). Personal Communication.

Zervas, N., Boyazoglu, J. and Hatziminaoglou, J. (1983). The potential of Mediterranean sheep breeds for milk and meat production: Strategies of improvement. In: *Proc. Intern. Symp. on Production of Sheep and Goat in Mediterranean Area,* EAAP, October 17-21, 1983, Ankara, Turkey, pp. 1-23.

Zervas, N., Hatziminaoglou, J., Boyazoglu, J. and Georgoudis, A. (1991*). Production potential and breeding schemes of some Mediterranean sairy sheep breeds.* FAO, Animal Genetic Resources Information, No. 8, Rome.