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MANAGEMENT OF EUROPEAN SHEEP AND GOAT GENETIC RESOURCES[(*)]

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Summary

The European sheep population, estimated at around 220 million head, can be considered to have wide genetic variability both in phylogenetic origin, adaptability to different climates and production systems and also in purpose and productive specialization. The maintenance of extensive or semi-extensive production systems, where adaptation to the environment is necessary, together with little use of artificial insemination in sheep, are just some of the causes of this situation. As a consequence, crosses have generally been limited and the absorptions or substitutions of some breeds for others are not frequent. Besides, in those breeds where selection schemes have been set up, the danger of a strong decrease in genetic variability does not seem to arise since selection is generally carried out from a selection base of a large number of animals from many flocks in different environmental and production conditions.

Regarding the goat population in Europe, currently of approximately 29 million head, the overall situation is comparable to that of the sheep population, although in the south of Europe, when intensive systems are developed for milk production, a small number of very productive genotypes are used. Concerning the management of genetic resources in goat breeds undergoing selection, this selection is only important in a few dairy breeds where, on the other hand, a correct resource management is carried out.

Concerning conservation of genetic resources, in most Western European Countries central or regional administrations are becoming aware and taking measures to avoid the disappearance of breeds. In Eastern Europe and Turkey the lack of infrastructure and funding means may stop from taking efficient solutions.

Key words: Genetic resources, Sheep, Goats, Europe

Introduction

When commencing this report, it is imperative for us to refer to the publications of I.L. Mason about sheep and goat breeds (Mason, 1967, 1981, 1988, 1991). In these publications a description is made of these breeds regarding their geographical situation, morphological description, production systems, state of conservation and production purposes. Later, in Simon and Buchenauer (1993), updated references to sheep and goat breeds of European countries can be found. Furthermore, in many countries, books, catalogues or articles have been published on local sheep and goat breeds. This is why we are not going to include in this presentation a description of European sheep and goat breeds in the sense just mentioned, but will focus on the use of these breeds.

For this presentation we have considered as European the forty-four countries which are usually included in this geographical region, but also Cyprus, Israel and Turkey have been included following the FAO criteria (Scherf, 1995).

Evolution of sheep and goat populations in Europe. Number of breeds and main purposes

According to FAO (1994), sheep and goat European populations are 219,998,000 and 28,822,000 heads, respectively; this represents 20% and 5 % of the world population. Sheep population is growing slightly since

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1979-1981, although the evolution is different depending on the economic areas because, while in the European Union countries there is a trend towards growth or maintenance, in other Easter European countries we are observing a strong decline. The countries having the greatest number of heads are: the Russian Federation with 41 million, Turkey 37 million, United Kingdom 29 million and Spain with nearly 24 million. With respect to goats, there is a decreasing trend in the 1979/1981 to 1994 period, mainly due to the great decline in Turkey -this country having still the greatest number of heads (more than 10 million)-. In the member countries of the European Union with important census such as Greece or Spain there is an increasing trend in the number of goats.

As for the number of sheep and goat breeds, Europe maintains a great diversity. The number of breeds varies according to the different authors; Simon and Buchenauer (1993), record 283 and 68 sheep and goat breeds, respectively, and Scherf (1995), 226 and 113, also respectively. This would represent 46% and 32 % of the whole world sheep and goat breeds (Scherf, 1995).

The European sheep and goat breeds have been grouped by Simon and Buchenauer (1993) according to the wool characteristics, geographical origins, type of use and genetic background into eight groups: Merino, Continental Longwool, British Longwool, Shortwool and Down, Milksheep, Heath, Mountain and local Coarsewool group.

Goats breeds are arranged by the same authors into ten groups: Saanen, Chamois, Toggenburg, Swiss Mountain, Maltese/Alpine/Garganica, Southern White, White with Black, Black or Red, Southern multicoloured and Nordic Landrace.

The main purpose of sheep breeds varies greatly but keeps a certain relationship with the geographical area. According to Simon and Buchenauer (1993), sheep breeds in Northern Europe have, with the exception of the milk-producing East Friesian Milchschaf, an orientation towards meat production, producing heavy carcasses up to 20 kg. In Mediterranean Europe we find milk breeds for cheese production that, in many cases, produce a very light suckling lamb, with a 4 to 7 kg carcass and meat breeds that normally produce lambs with a 10 to 15 kg carcass. In Eastern Europe we may find breeds whose main purpose is either milk, meat or wool.

With respect to goat breeds, they are mainly and normally milk producers.

Taking as criteria of genetic diversity the phylogenetic origins reported by Mason (1967) and Boyazoglu (1992), among others, together with adaptation to the environment and to the production system as well as production purpose of groups of breeds, it is possible to consider that the European sheep populations still conserve an extraordinary genetic variability.

The considerations that can be made with respect to the genetic variability of Mediterranean goat populations are similar to those we have made in sheep, namely, there continues to be a wide genetic variability concerning origin, adaptation to production systems and production purpose.

Breeds at risk and extinct breeds

The number of European breeds of sheep and goat considered at risk varies according to the criteria followed by the different authors. According to the FAO criteria (Scherf, 1995) 15 sheep breeds and 33 goat breeds could be considered at risk, whilst Simon and Buchenawer mention 12 sheep breeds as "endangered" and 37 as "critically endangered". For goat breeds, these figures are 4 and 16 respectively.

As for European extinct breeds, the FAO catalogue (Scherf, 1995) records 30 sheep breeds, out of which 19 were originally from the Russian Federation, and 5 goat breeds.

Performance recording and selection in sheep and goats

The conservation of genetic resources depends, to a large extent, on their adaptation to the demands of the production systems and markets. While a breed or population satisfies the production and economic exigences of the farmers, partial or total substitution will not be considered. This is why for breed conservation it is so important to set up production recording and pure breed selection programmes. The former, apart from enabling individual production data to be collected that can be used for selection, it facilitates the obtention of technical results which can be used in management programmes leading to an improvement of the productivity and profitability of sheep and goat farms.

Tables 1, 2 and 3 show the number of recorded flocks and ewes of dairy sheep, meat sheep and dairy goats, as well as the number of artificial inseminations (AI) and progeny tested rams and bucks per year, showing the existence of a working selection programme that could be of consequence to the breed, since the possible incidence of selection programmes based exclusively on natural mating systems is normally very limited. The results put forward in these tables have mostly been obtained within the framework of the FAO/CIHEAM Network on Sheep and Goats, Animal Resources Subnetwork.

Dairy sheep

In Table 1 it can be observed that in European dairy sheep, distributed mainly throughout the South and East, the dairy recording programmes are quite widespread in the European Union member countries with percentages of recorded sheep in relation to the total population of greater than 10% and with exceptional situations, such as that of the French dairy breed Lacaune in which almost the entire population is submitted to dairy recording.

The situation of the selection programmes are coherent, to a certain extent, with that of dairy recording, with very consolidated programmes in France, particularly in the Lacaune breed where selection affects a large part of the population, with more than 50% of the ewes inseminated every year. In other countries, such as Spain or Italy, great efforts are being made in some breeds to establish these selection programmes, but still involve only a small proportion of individuals in each breed, since, generally, AI is not very widespread. It must be pointed out however, that a large number of head of both rams and ewes are used in selection bases for these programmes, with normally more than 50 rams submitted to progeny testing every year, thus minimizing the risk of in-breeding. The results of the phenotypic and genetic progress being made in these programmes are a function of selection effort and long-standing nature of the programmes. In the Sarda, Manech and Lacaune breeds, phenotypic progress of 1.6%, 4% and 3.9% respectively has been estimated, whereas the estimated genetic progress has been of 0.3%, 2% and 2.4, respectively (Barillet et al., 1993). In the Latxa breed this progress is also beginning to be evident, with annual phenotypic progress of between 1.8% and 2.6% depending on the ecotype considered, and animal genetic progress ranging between 0.8% and 1.2% (Ugarte et al., 1995).

However, the most important aspect in breeds with established selection programmes, is that there is a market for rams whose breed is of a guaranteed genetic quality, which greatly contributes to the conservation of breeds.

Meat sheep

In Table 2 one can observe that performance recording in this type of breeds and are well developed in many European countries such as France, Norway, Spain, Iceland, Poland, Holland, UK or Rumania. Concerning selection programmes, only in Norway, Sweden, France and UK are they developed.

According to Danell (1991), a type of original selection schemes has been developed in Norway. They are based on the so called ram "cycles" where every year more than 2.600 rams are tested on progeny test on natural mating, making rams circulate among small farmers, so that they have progeny in different flocks. In Sweden, around 300 rams are tested each year, based on the use of AI rams as connection between a large number of small testing units (ram circles, flocks exchanging rams or ewes during the mating season, flocks testing own rams).

Regarding AI, this is hardly established in meat sheep, apart from in France.

The response to selection obtained in this programmes has been shown in Norway in advances around 1% a year in an aggregate genotype including growth rate, carcass quality and fleece weight (Steine, 1982, cited by Danell, 1991). About the same figure is expected in Sweden for growth rate in parallel with a corresponding improvement of pelt quality (Danell, 1991). In France, outstanding increases in the prolificacy in Lacaune breed have been revealed where prolificacy in natural mating of ewe lambs is 1.93 at present with an annual phenotipic increase of 4% in the last 15 years (Perret et al., 1995), and with an estimation of genetic progress of 0.016 lambs per parturition and year.

Dairy goats

The situation of dairy goats observed from Table 3 shows that only in the case of France, and to a much lesser extent in Spain, are dairy recording and selection programmes and AI important.

Crossbreeding in sheep

European sheep breeds have been crossed in order to improve growth and carcass quality, reproduction characters, especially prolificacy, dairy and wool production. These crosses have not been usually done in a systematic manner with the exception of the UK where a two-stage crossing programme, that can be considered as generalized, is applied: a first cross between local breeds from Scotland, Wales and Northern England and prolific breeds from the Longwool family that gives place to F1 females which in turn will be crossed with Down rams (Croston and Treacher, 1991).

Industrial or terminal crossbreeding

This type of cross has been used for many decades in most European countries. The Anglo-Saxon breeds (Suffolk, Hampshire, Southdown), the French breeds (Ile de France, Berrichon du Cher, Charmoise), German Merinos (Fleischschaf, Landschaf) and Texel have been the breeds most often used, and much scientific work has been published on the subject. The objective of these crosses has been relatively different depending on the geographical region: whereas in the Mediterranean countries, where local breeds are normally small in size, the main objectives have been to increase the growth potential of lambs and carcass weight, in Anglo-Saxon countries, with large breeds, the main objective has been to improve carcass conformation and produce leaner carcasses, the Texel breed being very suitable for this last purpose. However, these crosses have not become generalized in Mediterranean countries due to flock management problems caused by the introduction of imported rams (lack of adaptation to heat and walking, less sexual activity than the local breeds) and because in many countries light-weight lambs are still more highly appreciated (Gabiña, 1981). The consequences that these crosses have had on the autochthonous populations have not been of great importance, since substitutions or absorptions of the local breed for this type have not taken place, with some exceptions such as the Spanish and Portuguese Merino populations where there has been an influence of German Merinos and Merinos Precoces.

Crossbreeding with prolific breeds

The Romanov and Finn breeds have been used in the European countries in order to improve the reproduction traits of the local breeds (Espejo Diaz, 1989). The Romanov has been the most widespread in Mediterranean countries, mainly in France, both in crosses and also through the creation of several synthetic breeds, from which the INRA 401, with a population of more than 10,000 head distributed among 86 flocks (Institut de l'Elevage et al., 1993), is the most widespread. However, one could also say that this type of cross has had little influence on the Mediterranean sheep breeds.

In Northern Europe something similar has happened, since crosses with the Finnish breed have not been successful not even in breeds such as the Dam Line (Smith et al., 1979) which show very interesting productive characteristics.

Crossbreeding for milk production

The East Friesian and Sarde breeds were the first to be used to improve milk production in Mediterranean sheep breeds during the sixties and seventies both in crossing and in the formation of synthetic breeds such as the FSL or the Frisarta (Flamant 1974; Boyazoglu et al., 1979; Espejo Diaz, 1989). Currently the Awassi, the Assaf and Lacaune breeds are being used restrictively in crosses. The Chios breed is also being used to improve milk production in the East Mediterranean (Galal, 1994; Mavrogenis, 1995). We could also say in this case that such crosses have been little widespread.

Crossbreeding for wool improvement

This type of cross has been of relative importance in some areas such as Eastern Europe or Turkey, with the introduction of German Mutton Merino and the formation of breeds such as the Turkish Merino, the number of which is significant (>1.4 in number of head; Yalcin, 1986, cited by Galal, 1994).

Crossbreeding or breed substitution in goats

The general situation does not substantially differ from that of sheep production, however, a trend can be observed in the Mediterranean area of using highly productive European dairy breeds (mainly Saanen), either as a pure breed or in crosses with local breeds, leading even to absorption, on farms developing towards intensive or semi-intensive management systems. This situation has been described in France (Santucci, 1995), Italy (Rubino and Claps, 1995), Greece (Hatziminaoglu et al., 1995), Turkey (Tuncel and Rehber, 1995) and Israel (Landau et al., 1995).

In the case of Spain, the Murciana-Granadina is the breed becoming most commonly used in intensive situations (Falagan A., personal communication), now that their milk recording programme has been established and farmers can purchase guaranteed animals from the Breeders Association.

Conservation of genetic resources

In Lauvergne and Zafindragaona (1993), Simon and Buchenauer (1993), Loftus (1994), Quartermain (1991) and Scherf (1995), between others, we can find general views on the conservation of animal genetic resources in Europe. Bibliography on other particular conservation action in specific countries can be found in Bulgaria (Dimitrov and Dimitrova, 1994), Czech and Slovak Republics (Majzlik, 1992), France (Avon, 1983; Gilbert, 1983; Faure, 1992; Fiat, 1993; Djellali et al., 1994, Audiot et al., 1995), Hungary (Bodo, 1990), Italy (Matassino et al., 1993; Errante et al., 1995; Battaglini et al., 1995;), Nordic countries (Adalsteinsson, 1995), Poland (Wierzbowski, 1987), Spain (Rodero et al., 1990; Fresno et al., 1992; Fresno et al., 1995) and Turkey (Yener, 1995) and also on the action of NGO (Grunefelder, 1995). In most of these programmes, cryopreservation is used for semen and embryos, although in some cases ram circulation programmes have been established in order to reduce in-breeding (Djellali et al., 1994).

In general it can be said that in most Western European Countries central or regional administrations are becoming aware and taking measures to avoid the disappearance of breeds. In Eastern Europe and Turkey the lack of infrastructure and funding means may stop from taking efficient solutions. This fact may have serious consequences in Eastern Europe, where the dramatic decrease of population can involve the disappearance of relevant genetic resources.

Conclusions

The conclusion to be drawn from this paper is that European sheep and goat populations still conserve a large genetic variability, both concerning their origin and their adaptation to the different environments and production systems. The reasons for this situation should be attributed to the maintenance of extensive and semi-extensive production systems for which the local breeds are better adapted, and to the limited use of AI.

Regarding the management of genetic resources, performance recording and selection schemes are well developed on sheep breeds and to a leser extent on goats. On the other hand, the crossing schemes have had no repercussion on European sheep and goat populations, except in United Kingdom where a two-stage crossing programme has been kept stable.

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Table 1. Dairy Sheep. Recorded flocks and ewes. Number of Artificial Inseminations and progeny tested rams per year.

Country	Breed	Total population	Recorded flocks	Recorded ewes	% Population Recorded	AI/year	Progeny tested rams/year	Reference
Portugal	Serra Da Estrela	280,000	370	15,420	5.5			Gama, 1993
	Churra Terra Quente	150,000	44	4,240	2.8			Gama, 1993
	Mondengueira	15,000	18	638	4.3			Gama, 1993
	Saloia	55,000	28	1,150	2.1			Gama, 1993
Spain	Churra	1,776,000	87	25,861	1.5	15,994	50	De la Fuente et al. , 1995
	Latxa & Carranzana	440,000	257	79,077	18	13,922	70	CONFELAC, 1995
	Manchega	856,000	53	10,500	1.2	15,000	50-60	Montoro et al., 1993, 1994
France	Lacaune (milk)	725,000	376[1] 1,501[2]	156,624[1] 511,100[2]	21.6[1] 70.5[2]	115,000 255,960	445 ·	Barillet et al., 1993, 1994 Barillet and Astruc, 1994
	Manech & Basco Bearnaise	410,000	338[1] 147[2]	85,214[1] 33,833[2]	20.8[1] 8.3[2]	39,000	129	Barillet et al., 1993, 1994 Barillet and Astruc, 1994
	Corsica	100,000	84	17,480	17.5	1,000		Barillet et al., 1993, 1994 Barillet and Astruc, 1994
Italy	Sarda	3,700,000	850	102,500	2.8	12,000		Sanna et al., 1994, 1995
	Comisana	990,000	700	80,000	8.1			Sanna et al., 1994
	Marsese	102,000	94	8,500	8.3			Sanna et al., 1994
	Leccese	59,000	72	5,700	9.7			Sanna et al., 1994
	Langhe	20,000	115	3,750	18.8	600		Sanna et al., 1994, 1995
Greece	Karagounico	200,000	350	20,000	10.0	6,000	20	Georgoudis et al., 1995
	Lesvos	175,000	130	10,800	6.2			Barillet and Astruc, 1994
	Chios	5,000	15	1,400	28.0			Barillet and Astruc, 1994
	Frizarta	26,000	42	3,200	12.3			Barillet and Astruc, 1994
	Serres	38,000	70	6,400	16.8			Barillet and Astruc, 1994
	Sfakion	73,000	58	7,900	10.8			Barillet and Astruc, 1994
Cyprus	Chios	2,300	17	2,300	100			Mavrogenis, 1993
Israel	Awassi	5,000	1	1,200	24.0			Gootwine, 1993
	Assaf	40,000	5	5,000	12.5			Gootwine, 1993

[1] Selection nucleus; [2] Simplified recording

Table 2. Meat and Wool Sheep. Recorded Flocks and Ewes. Number of Artificial Insemination and progeny tested rams per year

Country	Breed	Total population	Recorded flocks	Recorded ewes	% Recorded	AI/year	Progeny tested rams/year	Reference
Belgium				6,500				Elsen and Bibe, 1988
Finland	1(3) Breeds	52,000	600	10,400	20			Danell, 1991
France	43 Pure Breeds [3]	6,365,000	1,981	315,761	5.0	254,000	130	Bodin and François, 1995 Institut de l'Elevage et al., 1993
	Berrichon du Cher	141,000	32	2,832	2.0	21,000	15	François, 1995
	Lacaune (meat)	838,500	111	24,474	2.9	11,645	38	Perret et al., 1995
Holland	Texel			77,000	14,0			Elsen and Bibe, 1988
Hungary[4]	20 Breeds		100	50,000				Kukovics, 1995
Iceland	Icelandic	780,000	1,200	164,000	21			Danell, 1991
Ireland	Galway			1,135	0,2			Elsen and Bibe, 1988
	Suffolk			2,535				
Norway	12 Breeds	950,000	7,800	248,000	26		2,600	Danell, 1991
Poland	Polish Merino	400,000		90,720	22,7			Martyniuk and Rzepecki, 1995
	Polish Lowland	230,000		61,834	26,9			Martyniuk and Rzepecki, 1995
	Polish Longwool	90,000		20,797	23,1			Martyniuk and Rzepecki, 1995
	Polish Mountain	90,000		6,786	7,5			Martyniuk and Rzepecki, 1995
	Polish Heath	2,500		1,577	63,1			Martyniuk and Rzepecki, 1995
	Meat Breeds	26,000		16,484	63,4			Martyniuk and Rzepecki, 1995
	Prolific Breeds	2,200		1,413	64,2			Martyniuk and Rzepecki, 1995
	Other	2,200		1,394	63,4			Martyniuk and Rzepecki, 1995
Portugal	Merino Branco	1,000,000	50	15,706	1.6			Gama, 1993
	Merino Preto	20,000	3	1,229	6.1			Gama, 1993
	Campaniça	10,000	3	1,554	15.5			Gama, 1993
Rumania	Tsurcana	4,600,000		49,597				Draganescu, 1995
	Tsigai	1,900,000		20,526				Draganescu, 1995
Spain	Rasa Aragonesa	2,777,190[1]	109	101,694	4.1	1,263	28[2]	Angra, 1995
	Rasa Navarra	310,000	30	30,000	9.7	4,000	15	Castillo, 1995
	Segureña	1,200,000	90	30,000	2.5	1,500	15	Serradilla, 1995
	Merina	2,500,000	93	37,275	1.5			FEAGAS, 1994
Sweden	14 Breeds	170,000	2,100	75,000	45		300	Danell, 1991
United Kingdom	60 Breeds		526	55,000			5 Sire Reference Schemes	Croston, 1995

[1] Including the Rasa Navarra; [2] Individual and progeny testing; [3] Including Berrichon du Cher and Lacaune; [4] Dairy flocks included

Table 3. Dairy goats. Recorded herds and does. Number of Artificial Inseminations and progeny tested males per year

Country	Breed	Total population	Recorded flocks	Recorded goats	% Recorded	AI/year	Progeny tested bucks / year	Reference
Cyprus	Damascus	2,500	18	2,500	100			Mavrogenis, 1993
France	Alpine	392,000	1,200	120,333	30.7	30,000	51	Barillet et al., 1994
								Simon and Buchenauer, 1993
	Saanen	181,000	750	93,009	51.4	19,500	21	Barillet et al., 1994
								Simon and Buchenauer, 1993
Greece	Skopelos	16,000	25	2,500	25.0			Pappas et al., 1992
Italy[1]	Ionica	14,000	23	1,299	9.3			Moioli, 1993
	Camoscieta (Alpina)	34,000	85	2,869	8.4			Moioli, 1993
	Saanen							
	Maltese	35,000	69	2,575	7.4			Moioli, 1993
		38,000	36	2,279	6.0			Moioli, 1993
Norway			370	17,400			140	Ricordeau, 1991
Portugal	Serrana	250,000	105	3,887	1.6			Gama, 1993
	Charnequeira	35,000	6	628	1.8			Gama, 1993
	Serpentina	100,000	6	462	0.5			Gama, 1993
	Algarvia	20,000	39	817	4.1			Gama, 1993
Spain	Malagueña	194,517	62	6,974	3.2			Serradilla, 1993
	Murciano-Granadina	382,660	203	20,663	5	770		Analla et al., 1995
								Falagan, 1994

[1] Only breeds with more than 1,000 does recorded