
Successful establishment of small ruminant recording systems in the Mediterranean countries

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The paper analyses different production systems involved in the small ruminant sector in the Mediterranean area and the Near East countries.

Summary

A questionnaire was distributed among 22 countries of the basin and the collected data were used for estimation of breeding values and selection; extension services including feeding requirements, reproductive information and pathology patterns; support strategies for livestock development.

The investigation underlines the relative importance of the sheep farming sector while goats are less important everywhere (their numbers amount to less than one third of the sheep). The national frame for the different sheep and goat breeds recording schemes is also reported together with the different breeding objectives of the various countries.

The advantages of on-farm recording schemes for meat traits are described: mainly due to the extension service activity played by the technician when visiting the flocks and the testing of the males (through the daughters) in various flocks, which means in various conditions and environments; the French case study is also reported as an example of efficiency. Different recording schemes are described with the involvement of private and/or public sector, depending of the national organisation; the efforts in the countries are mainly concentrated on the recording of traits for meat and milk characters.

Recording of dairy sheep, mainly concentrated in the European countries, is demonstrated to be different from meat sheep due to a much larger number of animals involved in the schemes and because the activity started several decades ago. Examples of sheep milk recording in various countries are reported and an analysis of the costs is examined.

The goat milk sector is described and recording schemes similar to those of sheep are also implemented for goats. Although goat milk is economically less important than sheep milk, in all countries where dairy sheep are recorded, the recording schemes are fully implemented also for goats.

Two elements are necessary for a successful recording scheme either for milk or meat production: the genetic trend measured in one population for the trait that has been chosen as breeding goal after a certain number of years of activity and the amount of recording costs that is paid by the private farmer.

Introduction

The purpose of this paper is to give evidence of the way in which small ruminant production systems benefit from animal recording activities.

In general, data collected through these systems are used for three major purposes: estimation of breeding values and selection; extension services including feeding requirements, reproductive information and pathology patterns; and help to making national strategies for livestock development.

The organization of genetic/production improvement in sheep, as for livestock, involves several structures: breeders' societies; flocks; individual performance stations; progeny testing stations; nucleus flocks; and insemination centres. The key role is played by those who decide, for each breed, the selection objectives and then the means through which the objectives are pursued, therefore, either a farmer' association or a centralized body, the Government itself or sometimes some research organization.

In this paper, the existing examples of recording schemes will be examined and the benefits that each system entails will be evaluated.

Sheep and goat farm production systems and flock management strategies in the Mediterranean/Near East countries are extremely variable; the most striking evidence is that sheep can be considered either a dairy animal or a meat animal, therefore, the procedures to achieve the defined breeding goal are totally different in the two production systems and are thus examined separately.

Table 1. Importance of sheep/goat farming in the Mediterranean/Near Eastern countries

Country	Sheep (thousand head)	% dairy	Goats	Sheep/inhabitants
Lybia	6 400	0	2 200	1.1
Greece	9 290	100	5 520	0.9
Syria	15 000	0	1 200	0.9
Iran	53 900	0	25 757	0.8
Tunisia	6 600	1	1 300	0.7
Morocco	16 576	0	5 114	0.6
Algeria	18 200	0	3 400	0.6
Portugal	5 850	16	793	0.6
Spain	23 751	25	2 600	0.6
Turkey	30 238	0	8 376	0.5
Jordan	2 000	0	795	0.4
Cyprus	250	100	300	0.3
Italy	10 770	60	1 365	0.19
France	10 240	30	1 199	0.17

Source: FAO Yearbook, Production, vol. 53, 1999; Authors' survey.

In this context, the following is considered:

- geographical distribution and attitudes of small ruminants in the Mediterranean/Near East;
- the performed trials of performance recording, selection activity and their justifications;
- the obtained benefits.

A survey through questionnaires was conducted in the following countries: Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Hungary, Iran, Iraq, Italy, Lebanon, Morocco, Poland, Portugal, Slovenia, Spain, Syria, The Former Yugoslav Republic of Macedonia (TFYRM), Tunisia and Turkey. We thank the people who contributed to this paper by answering our questions. Their names, address and position are referred to in the annex at the end of the paper. Data were integrated with literature, seminar reports, web page information and other sources (www.dgv.min-agricultura.pt; Benyoucef *et al.*, 1995; Boujenane, I, 1999).

The effort to establish recording systems and breeding schemes is worthwhile and the object of the programmes is economically important. To have an idea of the importance of sheep in the Mediterranean/Near East countries, Table 1 was drafted referring to the following figures and parameters: number of sheep (total head), percentage of dairy sheep,

Materials and methods

Results

Table 2. Sheep and goat breeds that are submitted to some kind of recording schemes, and their breeding goal.

Country	Species (S-G)	Breed/breeds	Breeding goal	Date of starting	Major responsible
Greece	S	Karagouniki, Lesvos, Sfakion, Serres, Hios, Frisarta, Mountain Ipiros, Kephalinias, Zakynthou	Milk	1980	Government
Greece	G	Skopelou	Milk	1980	Government
Syria	S	Awassi	Meat	1979	Government
Syria	G	Shami, Mountain	Milk	1979	Government
Iran	S	Qaraqul, Zandy, Kabudeh, Shiraz	Meat/skin	1990	Government
Iran	S	Zell, Sangsary, Shall, Lorybaktyary, Moqani, Lory, Afshari, Mehraban, Araby, Qashqae, Dalaq, Kordy, Taleshy, Kordy-khorasan, Bahmaee, Torkashwand, Haraky, Jomhoor, Kalhor, Shinbeh, Qezel	Meat	1990	Government
Iran	S	Makuee, Sanjaby, Baluchi, Kalekuhy, Nainy, Kermany	Meat/wool	1990	Government
Iran	G	Najdi, Adany, Talyi	Milk	1990	Government
Iran	G	Markhoz	Angora	1990	Government
Iran	G	Raieny, South Khorasan	Cashmere		
Tunisia	S	Barbarine, Noir de Thibar, Queue Fine	Meat	1990	Government
Tunisia	S	Siculo-Sarde	Milk	1990	Research
Morocco	S	Timadhite, Beni Guil, Sardi, Boujaad	Meat	1987	Farmers
Algeria	S	Hamra	Meat	1994	Government
Portugal	S	Merino Branco, Merino Preto, Campanica, Churra: Badana, Algarvia, Tenta quente, Galega bragancana, Galega mirandesa, Merino da Beira Baxa, Mondegueira	Meat		Government/farmers
Portugal	S	Saloia, Serra da Estrela	Milk		Government/farmers
Portugal	G	Algarvia, Bravia, Charnequeira, Serpentina, Serrana	Milk		Government/farmers

(to be continued...)

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Country	Species (S-G)	Breed/breeds	Breeding goal	Date of starting	Major responsible
Spain (Basque country)	S	Laxta blond-faced, Laxta black-faced, Carranzana	Milk	1982	Farmers
Spain (Navarra)	S	Laxta black-faced	Milk	1986	Farmers
Spain	S	Churra	Milk		Farmers
Spain	S	Manchega	Milk	1987	Government
Spain	S	Segureno	Meat	1990	Farmers/ government
Spain	S	Aragonesa	Meat	1994	Farmers/ government
Spain	S	Merino	Meat	1975	Farmers/ government
Spain	G	Malaguena, Murciano-Grenadina	Milk		Farmers/ government
Cyprus	S	Chios	Milk/meat	1980	Government
Cyprus	G	Damascus	Milk/meat	1980	Government
Italy	S	Sarda	Milk	1930	Farmers
Italy	S	Langhe, Comisana, Massese	Milk		Farmers
Italy	S	Appenninica, Barbaresca, Bergamasca, Biellese, Fabrianese, Laticauda, Gentile, Sopravissana	Meat	1980	Farmers
Italy	G	Saanen, Alpine, Maltese, Ionica	Milk	1980	Farmers
France	S	44 pure breeds, Lacaune (meat)	Meat	1960	Farmers
France	S	Lacaune, Manech, Basco-Béarnaise, Corsica	Milk	1955	Farmers
France	G	Alpine, Saanen	Milk	1968	Farmers
Macedonia	G	Alpine, Saanen, crossbred with local	Milk	1999	Research

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Country	Species (S-G)	Breed/breeds	Breeding goal	Date of starting	Major responsible
Slovenia	S	Bovec, Istrian, Bela krajina,	Milk	1982	Research
Slovenia	S	Jezerskosolcava, Texel	Meat	1982	Research
Slovenia	S	Saanen, Alpine, Boer	Milk	1988	Research
Iraq	S	Awassi	Meat	1966	Research
Iraq	S	Awassi, Arabi	Meat	1990	Research
Iraq	G	Black goat, Damascus goat	Meat	1990	Research
Egypt	S	Barki, Ossimi, Rahmani	Meat	1970	Research
Egypt	S	Farafra, Saidi	Meat	1996	Research
Egypt	G	Zaraibi	Milk	1996	Research
Egypt	G	Egyptian Baladi, Barki	Meat	1996	Research
Croatia	S	16 breeds	Meat	1994	Farmers/ government
Croatia	G	Sanska, Alpine, Njemacka, Burska, Domaca	Milk	1994	Farmers/ government

Source: Authors' survey; Cahiers Option Méditerranéennes, 1995 ; www.dgv.min-agricultura.pt

number of goats, and the ratio numbers of sheep/inhabitant (FAO, Yearbook, Production, 1999). This ratio gives evidence of the importance of sheep farming in each country and therefore of the opportunity of success that the establishment of a breeding scheme would entail. Countries are listed according to this ratio. In the table, only the countries where the ratio sheep/inhabitant was over 0.4 were reported, except when important breeding schemes were experienced even if the ratio was much lower.

From the table it is evident that for six countries of the Near East (Algeria, Iran, Libya, Morocco, Syria and Tunisia) and one European country (Greece) sheep play a fundamental role in the economy of the country.

Goats are less important everywhere: their numbers amount to less than one third of the sheep, except in Cyprus, where numbers of goats are slightly higher than those of sheep and in Greece and Iran where numbers are respectively 50 and 60 percent of the numbers of sheep. Therefore, if the mentioned ratio (sheep/inhabitant) is modified to sheep+goats/inhabitant, it is found that in Greece and Iran there is more than one small ruminant for each human being.

It will therefore be interesting to verify in which of these countries breeding schemes for small ruminants were implemented and what were the backgrounds, structures and eventually results.

The basic difference between sheep in North Africa and Western Asia and sheep of Europe is that in the first group of countries sheep are not milked, or maybe, they can be milked sometimes but their milk production does not enter in the marketing system. Recording and selection are therefore aimed to exclusively improve meat/fibre traits. In Europe, on the contrary, sheep milk in the marketing system is important: Greece and Cyprus 100 percent dairy sheep (although in Cyprus, for dairy sheep, also meat traits are recorded); Italy 60 percent; France 30 percent; Spain 25 percent; Portugal 16 percent.

All answers received have been condensed in Table 2, where the breeds that were submitted to any recording programme, the starting date of the programme and the organization running the programme are referred to, together with the selection purposes.

Of the necessary structures for the improvement of meat sheep, after the breeders' society which is responsible to decide on the breeding goals, the individual performance recording station plays a fundamental role: in fact, most of the traits have rather high heritability and they can be measured on the male. Stations allow accurate measurements and severe environmental control. Therefore, individual selection of young rams in the performance station is particularly efficient. Moreover, cost of

**Meat
performance
recording**

recording is lower in stations than on-farm. The most advanced form of the performance station is the one in which the males have been issued from planned mating. A nucleus flock is justified for populations of small size, because it provides conservation and multiplication of young stock. It is justified also in some developing countries, where shepherds are not prepared to participate in a breeding scheme, neither providing young rams to enter the performance testing stations or contributing to the cost of on-farm recording.

Also governmental flocks or research flocks in some developing countries could be considered as a kind of nucleus flock because they carry out the recording and selection activity with their own animals and staff with the purpose of spreading out the genetic improvement to private farmers through the sale of better animals.

A progeny testing station is justified if the traits to be recorded are not measurable on the male (like prolificity) and for the slaughtering characteristics.

On-farm recording is necessary for within flock female selection, for on-farm progeny testing (using AI males) and for management purposes. It is justified when farmers are prepared to pay for it.

Table 3 shows the importance of recording schemes for meat. It refers, for each country, to the number of non-milked sheep, the percentage that are recorded (considering any type of recording and registration of any event, on the farm or station); and the existing structures and facilities through which the recording/breeding activity is carried out. The fact that in the same country several structures are mentioned does not imply that everything applies to the same breed. On the contrary, in all countries there are several breeds, each of them has its own scheme and sometimes even different breeding objectives (Table 2).

From Table 3, the first evidence is that selection systems in all countries are based on the on-farm recording, either in associated flocks, governmental flocks or nucleus flocks (Algeria, France, Iran, Morocco, Portugal, Spain, Syria and Tunisia). On the contrary, in Italy only, the performance stations for males represent the fundamental means for the selection scheme. In France, the performance stations for males are only one of the components of the selection programme. We tried to analyse the difference in the interest of on-farm recording versus performance stations versus progeny test stations, and to understand why one tool is preferred to another in the different countries. The first point in favour of on-farm recording is the extension service activity played by the technician when visiting the flocks. It must be pointed out that a successful recording system must be based not only on the selection goal (genetics has long-term results, especially in harsh environments), while some benefits of this activity can be obtained in a shorter-term as an

Table 3. Meat performance recording: number of recorded sheep and structures involved.

Country	Total meat-purpose population (thousand)	% recorded	Structure of recording			Notes
			On-farm	Performance station for males	Nucleus	
Tunisia	6 600	1.7	Within flock selection	No	-	Recording activity fully paid by the government
Libya	6 400	-				
Syria	15 500	Irrelevant	no	No	Selection best rams for distribution to private	Selection is run by research staff of the government
Iran	53 900	1.0	Within flock selection	No	Selection best rams for distribution to private and AI	Selection is centralised in governmental flocks depending on the Ministry of Agriculture (no link with research)
Morocco	16 576	1.7	Within flock selection	No	Selection best rams for distribution to private	Selection is run by farmers' union: farmers pay .2 US\$ for each animal in the program = 1/150 th of the price of a female ewe aged 6 mo. The union receives a 4-yr contribution by the government, and appoints its own staff (42 people).
Algeria	18 200	Irrelevant				Selection is run by research staff of the government
Turkey	30 238	Irrelevant				
Jordan	2 000	-				
Portugal	5 200	1.7				Farmers' associations/Ministry Agriculture

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Country	Total meat- purpose population (thousand)	% recorded	Structure of recording			Notes
			On-farm	Performance station for males	Nucleus	
Spain	17 000	2.9	Selection of best animals in all recorded flocks	50 stations (Segureno) 33 stations (Merino)	Selection best rams for distribution to private	Selection is run by regional administration. Cost of recording is averagely 6-10 Euros/animal/yr, the farmer contributing for about 15-20%
Italy	4 000	4.6	Within flock selection and management	Selection best rams for distribution to private (all breeds)	Selection best rams for distribution to private (only Fabrianese breed)	Purpose of on farm recording is management. Selection is run by farmers' association (receiving 80% funding from government).
France	6 000	1.5	Among and within flock selection and management	Selection best rams for distribution to private and AI	One breed: INRA 401 (20 yrs. Activity)	Cost of recording is 1 kg meat/year/ewe; 80 % is paid by the farmer.
Croatia	461	13	Among and within flock selection and management	Selection best rams for distribution to private		Selection run by Croatian Livestock Selection Centre

Source: Authors' survey; Gabina, 1995 ; Cahiers Option Méditerranéennes, 1995.

improvement in the flock management conditions. Recording activity is a way to send a technician into the flock and to advise the farmers. Furthermore, we would add an important point in favour of on-farm recording. On-farm recording allows the testing of males (through the daughters) in various flocks, which means in various conditions and environments. The result is that we select not only production genes but also adaptation genes and fitness genes. This is of great interest, because it is possible to show that selection does not lead to a loss of adaptation and rusticity (important point in our Mediterranean conditions with local breeds and harsh conditions).

The major constraint of on-farm recording is the cost. The recording in the performance station is less expensive than on-farm recording; this is the only reason for which this system is used in Italy, where manpower costs are very high, and the farmers are not yet prepared to pay more than 20 percent of such costs. The Government therefore prefers to finance the building and the running of performance stations, where the activity is organized by the farmers' cooperatives themselves. In any case, the performance station system also requires the cooperation of the farmers in giving the stations their young rams, in participating to the planned mating and in contributing to the costs of the structures. Therefore, the farmers should be convinced that these activities bring collective progress. In Italy, performance recording of sheep for meat purposes is strictly finalized to produce top rams that are sold to the shepherds through auctions.

In France, finally, all the three tools of the selection schemes are used:

- performance recording on-farm in order to get data about prolificacy, milking ability (assessed from pre-weaning growth rate) and sometimes 30-70 day growth rate;
- recording stations (individual performance recording stations), where young rams, after a period of adaptation, are fed ad libitum during eight weeks (from the age of three months to the age of five months); records concern growth, conformation and fatness;
- progeny testing station for meat production (the best rams selected from the recording stations). Sires are mated to ewes and the progeny (30 lambs per sire) is measured for body growth and later carcass performance. A great number of traits are recorded at slaughter for genetic assessing of butcher features. About 10 breeds in France use the three tools in their selection scheme. The other breeds have a simpler situation, often without any progeny test step.

Therefore it is evident that France has achieved a more comprehensive control of the sheep production and selection system, proved also by the percentage of meat purpose recorded sheep (Table 3). There are two reasons for this success: the first is the long history of the recording activity in France, which has been carried out for decades through the constant cooperation of different organizations: the Government, research, and

most important, the farmers; the second is the gross margin per ewe, which is higher in France for the higher value that sheep meat products have compared to other countries. Traditionally, lambs, heavier lambs and mutton have an excellent position on the French market. In Italy, on the contrary, sheep meat is in many cases considered a by-product of milk and the demand is limited to local markets only.

Let us now analyse the difference in other systems of on-farm or nucleus flocks that arose from the survey (Iran, Morocco, Portugal, Spain and Syria). They are only apparently similar, but each one is unique. The Morocco example is the most similar to the European system: the nucleus is run by a farmers' organization; farmers pay a fee for each recorded animal and can buy the best rams issued from the nucleus, but not the very best, which are kept in the nucleus for the planned matings. Although the financial participation of the Government is necessary (the Moroccan farmers' organization receives regular fundings for this activity) the participation of the farmers is a must. In Spain also, the recording and selection activity is fully carried out by a farmer's cooperative, established at local level. Each sheep breed in Spain is reared in the region of origin. The Ministry has only a function of supervisor of the activity and gives partial funding to the farmers. In Portugal, the recording and selection activity is carried out by the *Sociedade Portuguesa de Ovinotecnia e Caprinotecnia*, strictly linked to the Government but in which the herd book farmers directly take part. It must be noted that the mentioned society has not only the purpose to improve meat productivity through recording and selection but also to promote the particular animal product from each breed. This is done through defining the production regulations for a type of lamb which receives a special denomination. Regulations include the age and weight at slaughter, the type of feeding and the area where it must be produced, etc. This aspect goes beyond the mere recording and selection purpose, but gives an example of the benefits that farmers can receive when they associate themselves and cooperate together to improve the breed.

The Iranian scheme, on the contrary, is totally run by the Government, which is the owner of the main nucleus flocks for each breed; such flocks or stations are nothing else but big flocks where selection objectives are pursued, i.e. where measurements and registrations of the traits, evaluation and selection of the top rams and *élite* ewes are performed within the flock itself. However, except for the rams that will be used for semen collection, the remaining best rams will be distributed to private farmers who participate in the recording scheme and are assured that some simple recording activity is performed in their flocks. In this case, on-farm recording does not contribute to the selection of the top rams among flocks, but helps the farmer to choose the female replacements. This system implies a will of the farmer to participate (in some cases he pays a reasonable fee). The uniqueness of the Iranian system is that it aims at long scale improvement of sheep production in the country.

In Syria, recording and selection activities are controlled by the Government, but through the national research institutions. There are few big flocks where sheep are recorded, evaluated and selected. The top rams, except those that will be kept in the selection flocks, are sold to private farmers, but due to the small numbers of evaluated rams, the benefits all over the country are irrelevant.

To date, it could be concluded that the final goal of sheep recording for traits concerning meat/fibre yield is, in all countries, the genetic improvement of livestock. If we would like to judge the success of such activities, the optimal indicator of the produced benefits is of course the genetic trend calculated over a consistent numbers of years. However, intermediate indicators could also be very useful, for example the circulation of better animals in the population. Therefore, Table 4 has been drafted, in which the numbers of evaluated animals are referred, together with the mention of the numbers of those that were considered the best rams, and those that were sold to private farmers. As not all replies have specified the numbers of evaluated rams and in order to have a rough estimate of the number of selected rams out of those evaluated, we assumed the total number of rams as half the number of ewes included in the selection scheme. Our purpose here is not to discuss about selection intensity, but simply to show how different the approach to selection could be. The number of selected rams is very variable: from 40 percent in Syria to 30 percent in Italy, to less than 3 percent in some breeds of Spain, and to 1 percent in France. It is evident that in countries like Syria or Italy the responsible organization for the selection activities prefers to distribute as many improved rams as possible instead of keeping the threshold too high. Many people are convinced that it is more fruitful to make the recording system known and appreciated through the sale of more animals than to limit the rams to be distributed to the very best ones.

Table 4 requires further comments. In most of the responses we received from the countries where several flocks are recorded, a common statement was that it is difficult to evaluate together rams of different flocks, as the flocks are poorly connected. In fact, even if they were connected purposely, through the exchange of breeding stock between flocks, it would anyway be feeble. Artificial insemination, which is the only way to create a reliable connection, is in fact poorly applied in sheep (Table 4). In this case, the evaluation of the rams in a performance station for males only is a means to overtake such a constraint; Italy has chosen this system also because AI in meat sheep is not very popular. In the performance stations, rams are simply evaluated from their own performance, after raising them in the same environment from the earliest possible age. However, with this system, female traits like prolificity cannot be recorded.

Table 4. Selection activity concerning meat sheep in the countries where performance recording is done.

Country	Means for selection	No. selected rams/year and % selected out of the evaluated	Number and use of the best rams	Number and use of the second best rams	No. artificial insemination intervention/year
Syria	5 experimental flocks with 1 800 ewes	400 (44%)	190 maintained in the flocks	210 sold to private farmers	-
Iran	Within flock (governmental and private) by expert judges	7 187 (7.4%)	500 for semen collection	6 687 sold to private farmers	30 000
Tunisia	250 recorded flocks	-	-	-	-
Morocco	Open nucleus (20 flocks)	202 (4%)	20 retained in the nucleus	182 sold to private farmers	-
Italy	Individual performance stations for 8 breeds	149 (46.8%)		149 sold to private farmers	-
France	1 648 recorded flocks; 23 individual performance test stations; 2 progeny test stations; 1 nucleus flock.	1 548 (1%)	550 sold to private farmers for controlled mating; 298 for semen collection	700 sold to private farmers for mating groups	60 000
Spain Segureno breed)	97 recorded flocks (12 000 ewes)	160 (2.6%)	110 retained in nucleus; 50 for semen collection		3 000
Spain Aragonesa breed)	172 recorded flocks (45 000 ewes)	-			10 000
Spain (Merino breed)	114 recorded flocks (68 00 ewes)	500 (0.7%)	500 sold to private farmers for controlled mating		
Croatia	739 recorded flocks (30 000 ewes)				

Source: Authors' survey; Gabina, 1995 ; Cahiers Option Méditerranéennes, 1995.

A further comment on Table 4 needs to point out the extent of artificial insemination; it is a practice still scarcely applied even in the more developed countries. This is a further hindrance for the genetic improvement of all the sheep population and not only a small group of farmers.

Although the recorded traits can vary from country to country, the only one which is considered important everywhere is the growth rate at a few basic ages. Moreover, prolificity and female traits, even if they are recorded on many occasions, are not, in general, included in any evaluation scheme.

We suppose that this is caused by the difficulty to set up an aggregate index, because of lack of knowledge of the necessary parameters, such as genetic correlations between the traits and computing difficulties. However, the collection of such data might prove useful in the future.

Finally, it must be mentioned that the recording of traits different than meat traits, such as skin yield and fleece, are not popular at all. In fact they are recorded only in Iran for some specialized sheep breeds and in France for the Merino sheep (Table 2). In these cases, skin or fleece quality and yield measurements are performed together with the weights and reproductive performances.

Two further experiences of sheep recording/selection activities need to be mentioned here. In fact, although the present survey was addressed only to the countries where sheep play a fundamental role in the national livestock production systems, valuable replies were received also from Egypt and Iraq. In these two countries, small ruminants are less important than cattle or buffaloes; however, either at local level, or for tradition, they substantially contribute animal food to human population. In Egypt, a continuous selection programme for meat sheep has been run since 1970 for three sheep breeds (Barki, Ossimi and Rahmani) and since 1996 for Farafra and Saidi breeds. It is carried out in four nucleus flocks, belonging to the central government and run by research staff of the national research institute. The nucleus flocks host about 2 000 ewes and 172 rams. Selection is done on the basis of post-weaning growth (males), prolificity, early age at lambing, interval between lambings and reduced seasonal anoesturs (females). Out of the young rams issued from the nucleus, 62 percent is sold to private farmers; 30 percent maintained in the nucleus and 8 percent used for semen collection (770 interventions/year). The management of semen as well as artificial insemination are carried out by the research institute.

In Iraq, from 1966 to 1990 a breeding programme was conducted at the University of Mosul, including 927 ewes of the Awassi breed; selection was done on the basis of early lamb growth, post-weaning growth, wool

Conclusions about meat sheep systems

Table 5. Performance recording and selection activity in milk sheep.

Country	Total female population (1000)	Recorded ewes no. and %	Indexed ewes (active)	Indexed ewes (active + historical)	Indexed rams (active)	Ai progeny tested rams/year	Indexed rams (historical)	Outputs for farmers showing genetic merits	Costs (litres milk/year) and % paid by farmers
France	1 395	877 747 (63%)	289 000	1 492 000	1 030	690	21 270	Electronic files edited by INRA	4 60%
Spain	2 377	111 900 (4.7%)	100 420	444 905	5 241	586	17 820	Ram catalogue; flock sheet for ewes	8.35 (20%)
Italy	6 147	418 271 (6.8%)	183 000	3 780 000	5 000	80	1 300 000	Ram publication in farmer's magazine	25 (20%)
Greece	9 261	55 832 (0.6%)				In course of preparation			? (0%)
Portugal	500	21 400 (4%)				In course of preparation			??
Slovenia	2.8	1 162 (6.8%)				In course of preparation			25 0%
Cyprus	73.6	7 500 (1%)	4 000		3 500			In course of preparation	? 0%
Tunisia		2 000	-	-	-	-	-	-	-
Croatia	85 000	1 141 (1.7%)							

yield (males) and prolificacy. Furthermore, a continuous selection programme for meat sheep has been run since 1990 for two sheep breeds (Awassi and Arabi) in nucleus flocks belonging either directly to the Government or to the Universities of Baghdad, Basrah and Mosul. About 2 000 sheep are reared in these flocks; selection is done on the basis of post-weaning growth, conformation and mature size (males), prolificacy, maternal ability, early age at lambing, interval between lambings and reduced seasonal anoesturs (females). Moreover, wool quantity and quality are also considered. Every year 300 best rams are distributed to private farmers for use in mating groups.

The milk performance recording and selection activity of dairy sheep (Table 5) is totally different for three main reasons: a much larger number of animals is involved in the schemes; the activity started several decades ago in most countries therefore the benefits are already evident; and it is performed only in Europe. The previous considerations allow a few comments and questions on the causes for that. In sheep farming, is milk production such a profitable activity that pays back the costs of the recording and selection activity? The answer to this question is very likely positive. A few comments on the costs will be given at the end of the paper; for the moment, evidence of the importance of selection in dairy sheep is given by the following figures:

1. Sixty-three percent of the French dairy ewes are milk recorded; a consistent percentage, between 4 and 7 percent is recorded in Spain, Italy, Portugal and Slovenia; about 1 percent is recorded in Greece, Cyprus and Croatia.
2. Common features of the recording activity in all countries is that it is carried out in associated flocks (only for one Italian breed, the Belice, is there an open nucleus system); a farmers' association plays the key role in the activity; connection is given by the AI or simply through the exchange of breeding stock from sales; calculation of genetic merit and animal indexing includes both living and historical animals (i.e. those that have been recorded in the past decade); all the recorded ewes enter the genetic evaluation system. The last item is a key factor to make the shepherd aware of the usefulness of the recording activity. When the records are not used for the genetic evaluation, it is difficult to explain to the farmers why he should join this activity. The publication of genetic indexes for all animals, through ram catalogues (Spain), flock sheets (Italy and Spain), electronic files available to the farmers (France) is a concrete response to the efforts of farmers, and also in other countries (Cyprus, Greece and Slovenia) the activity of milk performance recording in sheep aims to obtain this kind of output in the short-term.
3. Two interesting cases are found for the Lacaune sheep in France and the Chios sheep in Cyprus, where meat traits are also recorded and selected. The Lacaune breed is a particular case: the "meat Lacaune"

Recording of dairy sheep

Table 6. Values of the genetic trends obtained for milk traits.

Trait	Breed	Country	Years	Genetic trend	Citation
Lactation milk yield	Lacaune	France	1980-1992	5.7 litres/yr	Barillet F. and Boichard D. (1994). Proc. 5 th WCGALP, 18:111-114.
Lactation milk yield	Manech	France	1984-1992	2.1 litres/yr	
Lactation milk yield	Sarda	Italy	1990-1994	1.6 litres/yr	Sanna S.R., Carta A., and Casu S. (1995). In Proc Symp. SIPAOC 7 Dec., 1995, p. 89-95.
Lactation milk yield	Laxta blond-faced	Spain	1985-1993	1.1 litres/yr	Ugarte E., Urarte E., Arrese F., Arranz J., Beltran de Heredia I. and Gabina D. (1995). Cahier Options Méditerranéennes, 11:155-164.
Lactation milk yield	Laxta black-faced	Spain	1985-1993	0.8 litres/yr	
Lactation milk yield	Manchega	Spain	1986-1992	0.8 litres/yr	Jurado J.J., Serrano M., Perz-Guzman M.D. and Montoro V. (1995). Cahier Options Méditerranéennes, 11:133-141.

strain (which has evolved separately from the “dairy Lacaune” strain for 50 years) organizes its progeny test for growth and carcass performance on dairy ewes; “meat Lacaune” rams are mated on-farm (AI) to “dairy Lacaune”: the lambs are then fattened indoors and the carcass are “measured” at the slaughter house. In the Chios sheep post-weaning growth and prolificity are also taken into account in the selection scheme for milk production.

The cost that the farmer has to pay for this activity looks negatively correlated with the extent of the activity. In Italy and Spain, farmers pay only 20 percent of the total recording costs (while the Government pays 80 percent); in France, farmers pay 60 percent; in Cyprus, Greece and Slovenia farmers pay nothing. A suggestion might be deduced from these figures and from reports concerning the costs of the recording activity of different livestock in many countries, and this is that farmers should be first made aware of the benefits derived from the recording activity. It must be noted, however, that if French farmers currently pay 60 percent of the cost, at the beginning of the programmes (sixties and seventies), they paid maybe less than 10 percent. It is because of the success of the programmes that they pay 60 percent today. Given that the recording system has no short-term results and that the programmes must be collective, the Government must invest at the beginning. What is important is to make the transition when the programme is becoming successful. Nevertheless, the Government (or the research institute) must continue to realize some collective activities (calculation and publication of breeding values, collection and storage of data from recordings, etc.). Therefore, recording activity should be initiated providing incentives to the farmers or at least without asking them any fee; in some developing countries it proved successful to involve the farmers by giving them free feedstuff or vaccines (Trivedi, K., 2000); only after low cost useful information on individual animals, such as milk yield, conception rate, health parameters, are available, might the farmers be prepared to pay part of the costs to receive more and more information, including feeding advice from the monthly visit of the recorder and even the genetic merit of each animal of his flock. This activity should be supported by a continuous effort to increase the awareness of the benefits they could get from this activity: in this context the recording organization plays a very important role in finding the most suitable means to reach the farmers: meetings, seminars, workshops where scientists could be invited, stimulate competitiveness between them, etc.

Although goat milk is economically less important than sheep milk, in all countries where dairy sheep are recorded, a similar scheme is implemented also for goats. Table 7 summarizes the situation. In Cyprus, France, Greece and Italy, selection in goats is a photocopy of the dairy sheep selection system. Less animals are involved, on one side because goats are less in number, on the other side because the schemes were

Recording of goats

Table 7. Performance recording and selection activity in goats (milk yield).

Country	Total female population (1000)	Recorded goats no. and %	Indexed does (active)	Indexed does (active+ historical)	Indexed bucks (active)	AI progeny tested bucks/year	Indexed bucks (historical)	Costs (litres milk/year) and % paid by farmers
Iran	6 000	7 200 (1.2%)			370	44		? (0%)
France	800	300 000 (35%)			46 000	180	1 600 000	70 (50%)
Italy	700	25 000 (3.6%)	22 054	49 000	2 800			70 (20%)
Greece	2 600	4 254 (0.09%)						? (0%)
Portugal	470 000	24 500 (0.5%)						
Slovenia	13							25 0%
Cyprus	8	3 500				In course		? 0%
Syria	740	irrelevant	800		200			
Macedonia	?	800						
Croatia	39	2 774 (7%)						

implemented later on. Also the cost of recording is similar in the two species as well as the participation of the farmers. The same methodology is used for the data collection and genetic evaluation. In fact, in Cyprus, Greece and Italy, the same organization runs the scheme for both sheep and goats. In France the two schemes are run by separate organizations, but the second has taken advantage of the expertise and experience of the former one. Moreover, also Cyprus, Greece and Italy have taken advantage of the French experience, through visits, training received by that country and regular exchange of information.

Iran is the only country where a recording system for dairy goats was established, with no reference to any dairy sheep system (no milk sheep exist in Iran). The system was established in 1990, and it aims to achieve the genetic improvement of the breeding stock for milk within the overall goal to increase goat milk production in the country. As in the case of meat sheep, also for goats, in Iran, a highly centralized recording and selection system is employed, which is fully supported by the Government. Recording activity is performed in pilot (governmental) or associated flocks, with governmental staff.

As Table 7 only refers to the relevant data of dairy goats, we have to mention here that in Iran other recording systems and selection programmes are being run for goats, for fibre traits. This is the case of the angora production from the Markhoz breed, 1 200 recorded animals, i.e. 4 percent of total breeding stock; and also cashmere production from the Raieny and South Khorasan breeds, 8 600 recorded animals, i.e. 2 percent of total animals of these breeds. Recording of these breeds is also centrally organized, in pilot and associated flocks, controlled by governmental staff. For the three of them, beyond hair production and quality, also growth parameters are recorded, and selection within flocks is performed considering both fibre and meat traits.

Small ruminants are often situated in harsh areas (mountains, dry areas, bad pastures), and the gross margin per ewe or goat is less important compared to cattle. These facts explain that recording systems are less developed than with cattle and are more difficult to establish particularly if we do not adapt the tools used in cattle. Consequently, the simplification of the milk recording systems (for example the use of AT or AC methods instead of A4 design) is very important in small ruminants if we want it to be developed and successful.

What is the meaning of successful recording systems, and how can the success be assessed? At least two items are necessary: the first is the genetic trend (Table 6) measured in one population for the trait that has been chosen as a breeding goal after a certain number of years of activity. In France (Barillet, 1997), it has been proved that the milk recording activity in sheep was successful because the average genetic merit of the Lacaune

General comments and conclusions

animals was almost 6 litres of milk higher after every year of activity. For the other breeds (Italian and Spanish) the genetic trend ranged from 1 to 2 litres.

It should also be emphasized that a successful recording system must be based not only on the selection goal (genetic has long-term results, especially in harsh conditions): the recording system must also foresee extension service purposes; it is a means to send a technician in the flock and to give advice to the farmers.

A second parameter for judging the success of the activity is to consider the amount of recording costs that is paid by the private farmer: the higher this amount is, the more the farmers believe that the activity gives them some benefits. However, these positive examples have been preceded by several years where the government has played a fundamental role in directing and funding the recording and selection activity. In this context, it is important to point out that a successful recording system must be thought of with the purpose of improving all the given population and not only a small group of breeders: this is basically the problem of the diffusion of the progress. Unfortunately, in the majority of cases the diffusion rate is low (as an example, AI is poorly used). However, the involvement of the governments is fundamental for the starting of any recording activity, and the policy-makers should be made aware that the results of the recording activity will help them to make national strategies for livestock development.

Moreover, the academics have been and are still very much involved in some stages of the programmes, such as data processing, genetic evaluation methods, etc. and they still play a very important role in the promotion of this activity. Any effort from the government and/or a research institution to organize a recording/selection scheme should be appreciated, even if it is at a low scale at the beginning, and apparently has no impact on the livestock production system of the country. For this reason we would like to express a positive opinion for the examples where this activity is carried out by research institutions (Table 2): Egypt and Iraq for meat sheep; Slovenia and The Former Yugoslav Republic of Macedonia for dairy goats; and Slovenia for dairy sheep. These examples could be the starting point of a wider programme of genetic improvement if the academics succeed in involving private farmers and policy-makers.

Finally, the recording systems and objective of selection must be in interaction with the users of the products: milk industry, slaughtering, and also consumers. In this context, further outlets are emerging which can expand the recording activity and involve in this way more and more producers. Recording of traits like product safety, health and traceability is nowadays extremely important. From widening and improvement of the services offered to the farmers and the consumers, the farmers themselves will obtain more benefits. We would like to point

out again the useful actions of the Portuguese Breed Societies through the establishment of the production regulations for some types of animal products of the Portuguese sheep breeds (typical cheeses and type of lambs), which consequently require specific controlling actions, and reach the market as products of superior quality.

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