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Mediterranean livestock production: Uncertainties and opportunities
Les productions de l'élevage méditerranéen: Défis et atouts

Mediterranean livestock production systems operate in an environment characterized by a high degree of dynamism and uncertainty. Mediterranean livestock farming systems have adapted to these context and have taken advantage of the diversity of lands that characterise the Mediterranean area, interacting strongly with the land and the environment. Furthermore, the singularity of Mediterranean livestock products, appreciated by a wide range of consumers, and the contribution of the livestock systems to the maintenance of the natural environment as well as of the population fabric in many rural areas, are some of the strengths of these systems, which could provide an opportunity for their sustainability and development.

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The large participation and diversity of the contributions presented, as reflected in this publication (which contains 62 articles), show that this Seminar has contributed to the exchanges between researchers, technicians, and other professionals of the sector regarding the problems of livestock production systems in the Mediterranean basin and has also meant great progress towards consolidating the Mediterranean Livestock Network.

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Les productions de l'élevage méditerranéen: Défis et atouts

U. DE ZARAGOZA CIHEAM CITA

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Les productions de l'élevage méditerranéen : Défis et atouts

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Foreword

There is wide consensus today regarding the difficult period that agro-food firms are experiencing as a consequence of the different market trends (saturated markets, market liberalisation, concentration of the distribution sector, an increasingly fragmented and less consistent demand, etc.), leading to a rise in market pressure and competitiveness, a situation which will become more difficult in the future.

Thus, Mediterranean livestock production systems operate in an environment characterized by a high degree of dynamism and uncertainty. Likewise, the important threats of climate change and water scarcity are of special concern to livestock systems in the Mediterranean basin. Mediterranean livestock farming systems have adapted to these context and have taken advantage of the diversity of lands that characterise the Mediterranean area, interacting strongly with the land and the environment. Furthermore, the singularity of Mediterranean livestock products, appreciated by a wide range of consumers, and the contribution of the livestock systems to the maintenance of the natural environment as well as of the population fabric in many rural areas, are some of the strengths of these systems, which could provide an opportunity for their sustainability and development.

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The large participation and diversity of the contributions presented, as reflected in this publication, show that this Seminar has contributed to the exchanges between researchers, technicians, and other professionals of the sector regarding the problems of livestock production systems in the Mediterranean basin and has also meant great progress towards consolidating the Mediterranean Livestock Network.

The Mediterranean Agronomic Institute of Zaragoza is most satisfied to have been able to host this RME Seminar and publish the proceedings in the CIHEAM journal, *Options Méditerranéennes*. We would like to express our gratitude to all the authors and to the reviewers who have made this publication possible thanks to their invaluable and anonymous work. Likewise, we also thank the following institutions: Universidad de Zaragoza, Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA) and Departamento de Agricultura y Alimentación del Gobierno de Aragón.

L. Esteruelas
Director of IAMZ

A. Nardone
President of the RME Network

SESSION 1

Sustainability of the livestock production systems and adaptation strategies to the socio-economic environment

Durabilité des systèmes d'élevage et stratégies d'adaptation au milieu socio-économique

Mediterranean animal production: Development or decline?

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SUMMARY – The Mediterranean region has a very rich and long history of trade across the Mediterranean Sea in many industries and particularly in animal productions. The Mediterranean animal industries, and ruminants in particular, have some common traits such as the importance of pastoral systems, light and young carcass productions, numerous labelled and regional products and the predominance of small versus large ruminants. However EU and non-EU countries differ significantly in terms of standard of living, market protection, public subsidies or types of production systems. To try to analyse the potential development of these Mediterranean countries, we will overview some main issues of animal production. The development of Mediterranean countries livestock production will be conditioned by the animal farmers' ability to group together for production and/or commercialisation and to communicate more between Southern and Northern countries.

Keywords: Animal, production, Mediterranean countries, issues.

RESUME – *"Production animale méditerranéenne : Développement ou décline?" La région méditerranéenne a une très riche et longue histoire d'échanges à travers la mer Méditerranée dans de nombreux secteurs et en particulier dans les productions animales. Les secteurs animaux et ruminants en particulier de la Méditerranée ont des caractéristiques communes comme l'importance des systèmes pastoraux, les productions de carcasses légères et jeunes, de nombreux produits labellisés et régionaux et l'importance des petits ruminants comparés aux grands ruminants. Cependant, les pays de l'UE et hors UE diffèrent significativement en terme de niveau de vie, protection des marchés, subventions publiques ou types de systèmes de production. Pour tenter d'analyser le développement potentiel de ces pays méditerranéens nous étudierons quelques enjeux majeurs de la production animale. Le développement de l'élevage des pays méditerranéens dépendra de la capacité des éleveurs à se regrouper pour produire et/ou commercialiser et de plus communiquer entre les pays du Sud et du Nord.*

Mots-clés : *Animal, production, pays méditerranéens, enjeux.*

Introduction

The Mediterranean region, with about 700 million inhabitants, is a fabulous cultural melting pot built from very important and developed civilizations like, for the main ones, the Mesopotamian, Egyptian, Roman, Greek and Arabian ones. Thanks to the easily shipped Mediterranean Sea, a very long history of crossed cultures and market trade still make those countries feel close to one another, participating in a "Mediterranean culture". We will see that these countries have lots in common due to those traditional exchanges and similar climate. However, the European Union rise has created an economic "gap" between the EU and non EU countries over the last 50 years.

Even though the Mediterranean region reveals strong differences in terms of consumer behaviour or socio-cultural profiles, natural conditions or economic situations, we will try to highlight the main common issues relative to animal production.

A strong trade tradition across the Mediterranean Sea

We consider a country as "Mediterranean" if it has a Mediterranean coast. But this criterion does not mean that the countries are mainly under a Mediterranean climate influence. For example, we can notice that France and Slovenia have only a slight part of their territory under a Mediterranean climate, whereas Algeria or Libya have very wide arid areas.

Agriculture

Even though fish, poultry or pork (in the EU countries) are significant animal productions, we will focus more on the ruminant industry which is deeply linked to land use.

The common warm and dry climate allows hardly any types of agriculture productions, similar in every Mediterranean country. But at the same time, the low water availability in most of the non European countries (except Turkey and North Syria) is an important limit for yields/hectare and economic efficiency in those Southern countries.

There are strong differences between the Mediterranean countries in terms of ruminant production: northern countries, which benefit from a more favourable climate, have greater cattle herds than southern countries where dry climate and poor grasslands are more adapted to sheep and goat production, which we will call small ruminants (Fig. 1).

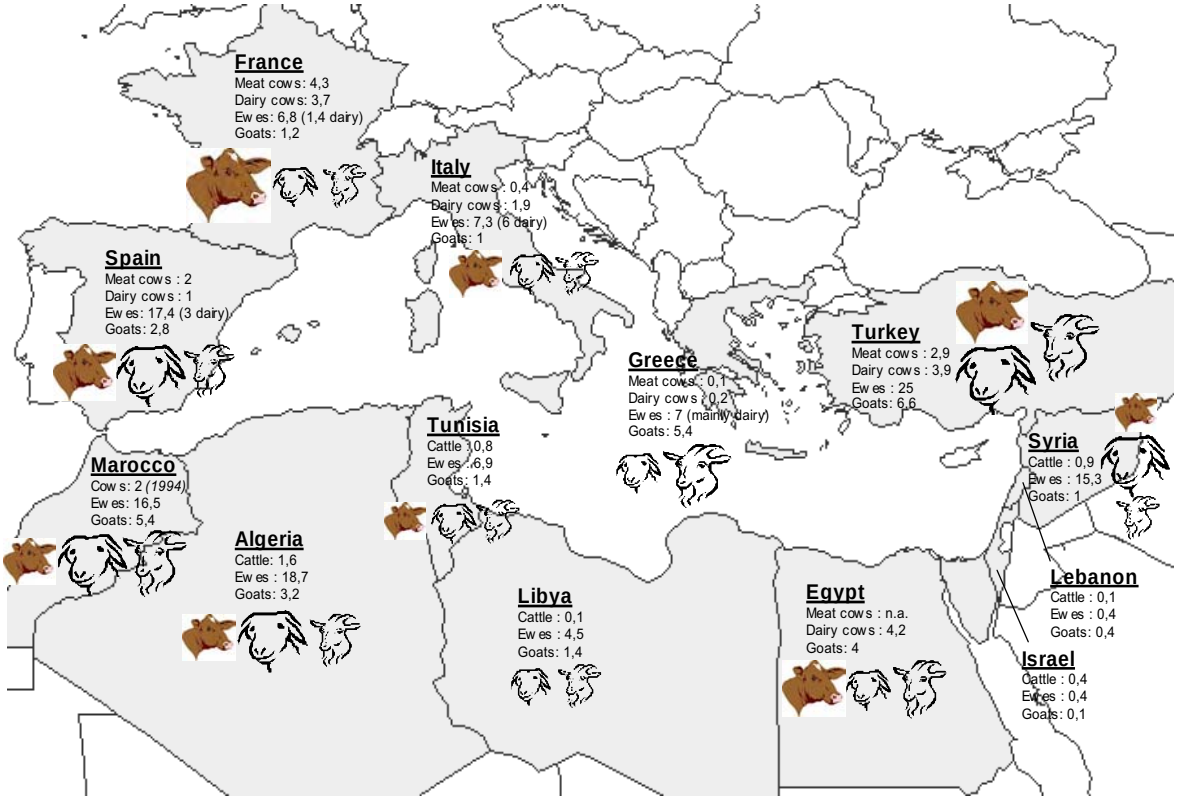

Fig. 1. Cattle herds, sheep and goat breeding flocks (millions of heads) in Mediterranean countries (GIRA Meat Club, USDA and FAO).

Bovine sector

Beef and veal production is concentrated in France, Italy and Spain. Turkey and Egypt also have a significant production (Fig. 2).

In the Mediterranean area, beef and veal production has increased by 7% in the last 10 years. It was around 4.7 millions tones in 2005. This is mainly due to the increase in the Spanish production (+40%). In this country, the number of suckler cows doubled during the last two decades, mainly because of the conversion of dairy farms after the implementation of the milk quotas and the joining of Spain in the European Union in 1986. Today, the suckler herd is developing beyond the limits of the suckler cow CAP premium and only 72% of the cows are granted. The production is organised between cattle breeders in extensive livestock farming systems in the West and specialised cattle fatteners concentrated in the Mediterranean area (Cataluña, Aragón, Valencia and Murcia). The

consumption of beef meat in Spain is 17 kg/person/year, which is quite low compared to other European countries, whereas pig meat consumption is the highest in the EU. Spain exports a lot of beef, mainly light coloured young bull and heifers beef, to Portugal, France, Italy and Russia (source: Eurostat).

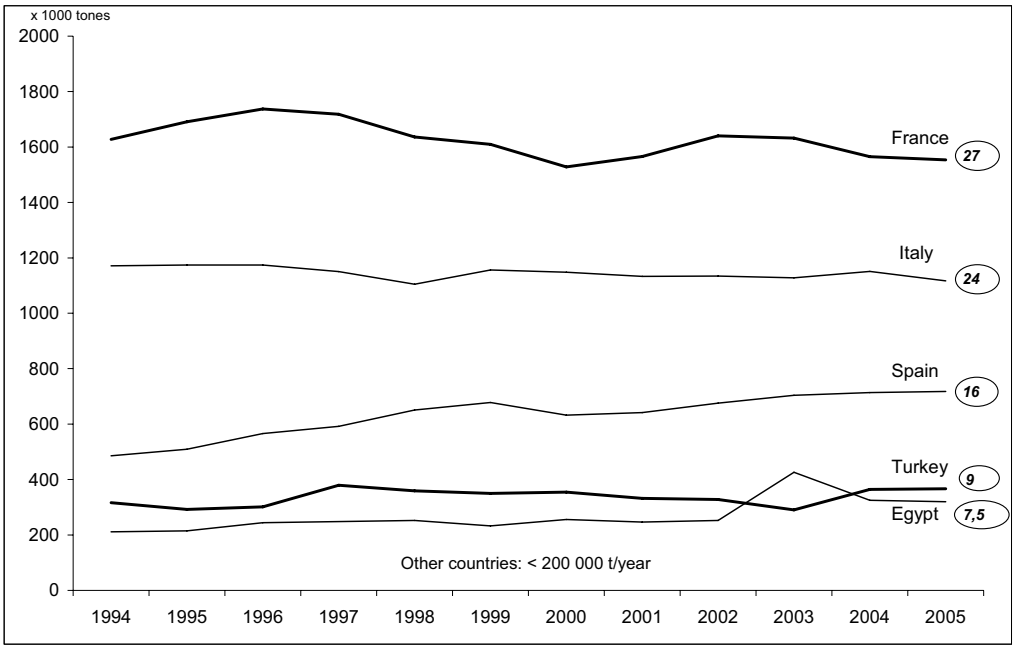

Fig. 2. Beef and veal production and consumption in Mediterranean countries (source: GIRA Meat Club and USDA). The circled number is the per capita consumption (kg/year).

On the contrary, in France and Italy, the first two beef producers in the area, production has been decreasing for the last 10 years, a consequence of the environmental measures of the 1992 CAP reform. Since November 2005, the suckler herd in France has been increasing again, encouraged by the very good market conditions.

France, which has the record for beef consumption in the EU, has had a negative balance of production/consumption since 1999 and imports around 370,000 tonnes of meat, 22% of its consumption. The Netherlands are its first suppliers, followed by Germany, Spain, Ireland and Italy. France exports around 17% of its production, mainly to Italy Greece and Germany.

Italy is self-sufficient for beef and veal with 65% of its consumption. Its main suppliers are Germany, France and the Netherlands. Brazil comes in fourth position and its sales have almost doubled in the last five years, reaching more than 50,000 tonnes.

A great part of the beef and veal trade is organised within the Mediterranean area: live animals are exported from France to Italy and Spain to be fattened. France also exports meat to Greece and Italy. European countries export beef and veal meat to Middle-East and North-African countries but Brazil is now the main supplier of these countries, representing 400,000 tonnes/year, four times the European exports.

Ovine sector

Turkey is the first producer of sheep meat among Mediterranean countries, despite a recent decrease that can be explained by the outbreak of Foot and Mouth Disease in 2001 (Fig. 3). The production in this country could even be higher due to the fact that the data are based on records from registered slaughters, which means that domestic slaughtering is not taken into account. This is quite common in southern Mediterranean countries and for sheep meat production, generally speaking.

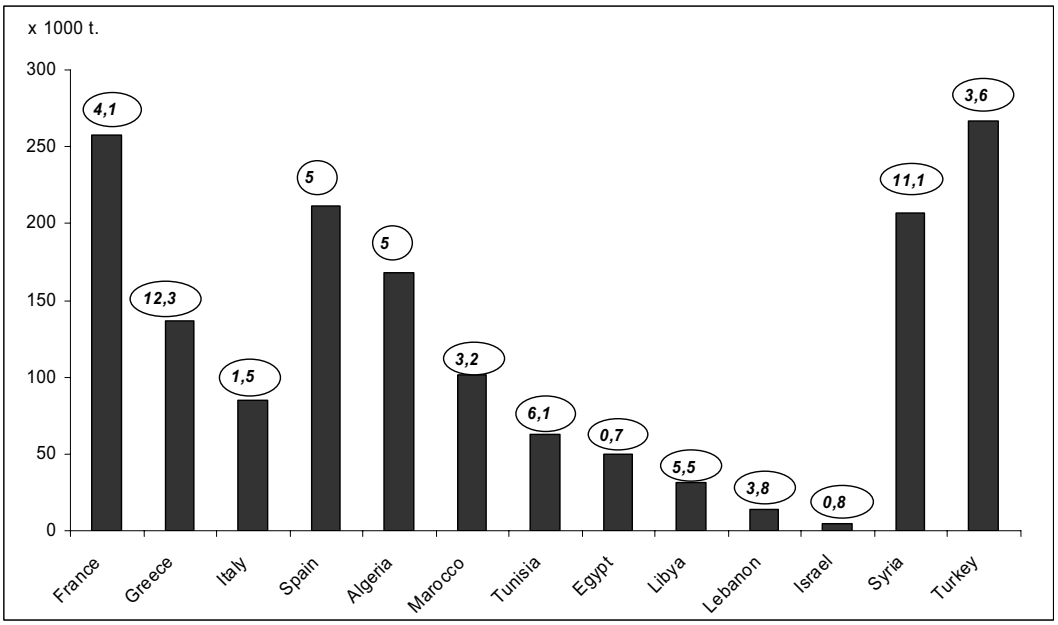

Fig. 3. Sheep meat production and consumption in Mediterranean countries (GIRA Meat Club). The circled number is the per capita consumption (kg/year).

In Syria, production has been affected by two episodes of drought conditions (early 90' and 1999-2001). It is now recovering its former level. The consumption par capita is high in this country (11.1kg).

In 2005, Spain had to face a serious problem of Blue Tongue Disease, which strongly affected its production (-4%) and its consumption (-9%). Spain remains nevertheless the second producer in the area and has shown a particular dynamism during the last decade compared to other European countries.

In France, the production is decreasing and the breeding flock is falling by around 1.5% per year. This trend mainly affects northern France, whereas the Mediterranean area of France has maintained its productions, supported by specific grants of the CAP second pillar. This is also due to the dynamism of the dairy sheep sector compared to the meat one in this country. France imports a large amount of sheep meat from the UK and Ireland (90,000 tonnes in total), but also from New-Zealand (40,000 tonnes), which has a leadership situation on the world market.

Greece has the highest consumption of the area and consequently imports a great part of it from Spain and New Zealand.

Other animal sectors

Goat meat is less important as its production represents between 5 and 30 thousand tonnes per Southern country, consequently about ten times less than sheep meat.

Camels are widespread in the Southern countries, but there are very few economic data about this production which is specific to the pastoral and arid regions. However, like in Australia where some people are thinking of developing the production of endemic kangaroos because of their perfect adaptation to arid environments, it may not be unrealistic to imagine that camels could have a development in semi arid Mediterranean regions.

Fish is an important animal sector in Mediterranean countries, like in Morocco which is considered to have one of the best fishing potential in the world. On the other side the hot water of the Mediterranean Sea allows fast growth for cage production of fish, like in Cyprus where tuna of more than 500 kg can be fattened in industrial offshore cage units.

A lot of common traits in Mediterranean animal productions

Importance of the pastoral systems

The Northern Mediterranean countries, including Turkey, have an average rainfall above 500 mm per year. Southern Mediterranean countries, such as Lebanon and Syria, are below this average of 500 mm. Finally, countries like Egypt, Libya and Algeria have an average below 300 mm of rainfall, mainly because of their wide arid areas (FAO, 2004). This lack of rainfall is also associated with very high temperatures. Because of the dry climate and consequently the lack of grass, the pastoral system is widespread in the Mediterranean regions as the animals are forced to move to feed.

Those hard climatic conditions often limit the systems to low levels of productivity. For instance, the important 2003 drought in France has led to a decrease of 10% in the annual goat AI fertility and more than 15% during the highest temperature of the first fortnight of August (de Crémoux *et al.*, 2005). Moreover, in semi-arid regions, like eastern Algeria, the grass availability period lasts around three months. This low availability limits the milk yield of dairy cows which ranges from 2100 to 3400 litres, depending on the calving season (Mouffok and Madani, 2005). For other sources, the average milk yields can even go down to 1000 litres per cow and year (Ghersi, 2002).

But let's mention that pastoral systems can be compatible with fairly good productivity. For example, on the dry pastoral plateau named Causses du Larzac in the French Roquefort area, some meat sheep systems with integral outdoor grazing have reached a high performance level of 170% of lambs/ewe with more than 250 g of average daily growth. These results have been obtained with a very precise stocking rate management, adapting the high need periods to the usual grass growth (Molénat *et al.*, 2005).

Importance of the young and light carcasses

The low forage availability leads the animal farmers to fatten rapidly their animal and consequently to slaughter them at light weights. Consequently, Mediterranean consumers are used to consuming 90% of their bovine meat as young and clear one, which is a Mediterranean specificity (Guesdon, 2004).

On the other hand, the frequent milking of small ruminants also leads to light young carcasses, as we can see on the Table 1 with the clear EU comparison of Northern heavy and Southern light lamb carcasses. For instance, the "lechal" in Spain or the "agnelli" in Italy have an average carcass weight of 10 and 7 kg respectively. In Middle-East countries, such as Turkey and, to a lower extent, Syria, a great part of lambs come from a specific breed, the Awassi, which is aimed at both meat and milk productions, with a specific fat tail. Carcass weights are therefore also high in these countries (average of 15.8 kg in Turkey).

Table 1. Comparison of lamb carcass weights in different European countries (European Commission, 1999)

Country	NL	GE	UK	FR	EU	SP	GR	IT
Kg carcass	25	20	19	18	15	11	11	9

Importance of labelled and quality products

The Mediterranean animal productions have a common trait which is an important tradition of Mediterranean food quality and consumption. In other words, there is a supposed "Mediterranean way of eating" with a good healthy international image. Moreover, there is a huge diversity of regional products linked to territories and culture, with frequent quality labels in the Northern Mediterranean countries.

Consequently, the Northern consumer could be fond of the Mediterranean diet, as it was shown in

a study comparing the consumer demands for Northern and Southern European lambs. In this study, the young and light Greek and French lambs fed with concentrates have been surprisingly the best appreciated by the Northern consumers (Sañudo and Alfonso, 1999).

Importance of small *vs* large ruminants

As shown on Fig. 1, we find a higher proportion of small ruminants in Southern Mediterranean countries. This trend of concentration around the Mediterranean sea is currently noticeable in France where the sheep flock resists better in Southern regions than in the Northern or Western ones. The better ability of sheep, compared to beef, to graze dry pastures and its lower need of water (half of average beef need per metabolic weight) is making sheep more competitive in dry areas.

A strong contrast between EU and non-EU countries

Even though we have highlighted some convergences for the Mediterranean countries, some elements seem to separate Mediterranean EU from non-EU countries:

(i) Religion: the dominant Christian religion for EU and Islam (except Israel, Lebanon and some ex-Yugoslavian countries) for non EU countries has an obvious effect on pork consumption and production for instance.

(ii) Climate: arid or semi-arid regions mainly in non EU countries with consequent contrasted productivities.

(iii) Economic differences are important, mainly due to the EU Common Agricultural Policy.

Standard of living and poverty

The Conference of Barcelona (gathering the Ministry of foreign affairs of the EU and the 12 Mediterranean non EU countries) launched in 1995, had as a target to create an area of shared prosperity among Mediterranean countries. This initiative has not had a great success as, for instance, between 1996 and 2000, the European funds respectively for Central European countries and non EU Mediterranean countries moved from 20%/80% to 80%/20%. However, some agreements for agricultural liberalisation have been signed between EU and Israel, Tunisia, partially with Lebanon and are about to be signed with Morocco.

The undernourished population percentage is below 5% in most of the countries except for Algeria, Morocco and some ex-Yugoslavian countries (FAO, 2004). Moreover, analphabetic level can be high in Southern countries, for example in Morocco where it reaches 75% in rural areas.

The dietary energy consumption is quite good for the Mediterranean countries (all above 2800 calories per capita and per day), especially if we consider the contrast with the majority of the more Southern African countries (FAO, 2004). Even though the child nutritional status is considered to be at a good level in every Mediterranean country, the situation in the Southern countries is considered to worsen from Turkey to Morocco (except in Tunisia and Libya) (FAO, 2004).

Though the economic situation is better in the North, the growth of agricultural production per capita is higher in Southern countries. For example, this growth was above 20% between 1993 and 2003 in every Southern country, except Tunisia. On the other hand, this growth was negative in most of Northern countries, except in Spain (FAO, 2004).

However, the World Development Indicators showed that, in 2000, the economic added value of an EU agricultural worker was still 13 times higher than the average one in Morocco, Algeria, Tunisia, Syria and Turkey. This shows that the economic gap between North and South is still very deep, having significant consequences on the market.

Market balance

According to CIHEAM (1999) and FAO, very few Southern countries are self sufficient in the main food products, contrary to EU countries. As confirmed in Table 2, North African and Near East countries are net importers for the main animal products.

Table 2. Net trade deficit in livestock products for North African and Near East countries, compared to average developed countries (FAOSTAT 2005). 1000 metric tonnes, average 2001-2003†

	North Africa and Near East	Developed countries
Milk equivalent	-6400	25894
Bovine meat	-351	346
Ovine meat	-108	277
Pig meat	-10	138
Poultry meat	-750	1072

† Negative value = net importer.

Egypt and Algeria are dramatically depending on food importations as they had a negative balance of respectively 2.7 and 2.2 billion euros in 2001. On the other hand, Turkey and Morocco are the only Southern countries with a positive balance of 2 and 0,2 billion euros in 2001. Morocco has a positive advantage in fish products and is considered to have one of the best fishing potentials in the world. But the prospective for 2010 in Southern countries (African coast and Turkey) reveals a need to import about 300,000 tons of meat and 3,700,000 tons of milk products (FAO, 2003).

Consequently, apart from France and, to a lower extent, Turkey, all the other Mediterranean countries are highly net importers in food with a percentage of (exports – imports)/consumed calories below minus 25% (FAO, 2004), and this situation may not change significantly in the short term.

Public subsidies

The important farm subsidies and market protections due to the CAP are of a great help for the EU farmers. Indeed, in the Southern Mediterranean countries, the economic situation usually does not allow the governments to support agriculture and give subsidies to farmers. This difference is very often debated both at Mediterranean and world levels because it is considered to close the European market to other countries and mainly the developing ones. However, there is some public support, like in Turkey, where the government provides premiums to encourage quality milk production, artificial insemination or the purchase of high genetic value breeding cattle.

Main issues for Mediterranean animal sectors

Water and erosion problems

Water availability and erosion are major problems in Mediterranean countries, as revealed by the recent draught in France, Spain and Italy, and more dramatically in Southern countries. Lipchitz (2005) estimates that there are three categories of water affected countries:

(i) Water has no real problem of availability: Turkey and Lebanon.

(ii) Water could have availability problems but it is possible to prevent this problem with important structures: Morocco and Algeria.

(iii) Very low water availability: Egypt, Syria, Israel and Tunisia.

The wind erosion is also a key issue for Southern countries as, with the combination of the climate warming (supposed to be of 3°C in 50 years in Maghreb) and the decrease of the forests, the sandy desert has absorbed a huge surface towards the North of Maghreb, like in Algeria for example. This situation is dramatically reducing the arable surface for farmers.

Land access for farmers

The conditions in which the small farmers could get out of poverty are principally the access to land, water, loans, insurances, information and education (Griffon, 2005).

In 1960, one out of three Mediterranean inhabitants was living in the South. In 2020, this ratio will be two out of three. Consequently, Maghreb countries have 3.8 inhabitants per used hectare and France has only 2 (Ghersi, 2002). This population increase can have negative effects like in the semi-arid regions of Sétif in Algeria, where the average farm size is decreasing due to the non division of the private land and the uncertainty of public land availability (Abbas and Madani, 2005).

Turkey and Syria, having a better land availability than the other Southern Mediterranean countries, are consequently the only ones with quite good food self-sufficiency.

Evolution of market barriers

The import taxes and export restitutions are progressively reduced by the WTO policy. Consequently, trade should be easier especially for Southern countries, which have generally low production costs, towards European countries. This could be an opportunity for Southern Mediterranean countries which will manage to have a surplus in some animal products.

However, a study published by the French Ministry of Agriculture and Fisheries shows that the liberalisation between EU and Mediterranean non EU countries would help the European countries to export their milk and meat products and help the Southern countries to export their fish products. Therefore, the effects of this liberalisation could have negative effects on the animal farmers of the South (Lipchitz, 2005).

On the other hand, we must notice that, after the hormones conflict between the USA and EU and the BSE crisis, diseases have become a fundamental market "weapon" and strongly affects consumption. For example, the Avian Influenza crisis on poultry consumption has consequently increased the beef meat consumption in Spain and Italy and the Foot and Mouth Disease in Brazil has reduced the Brazilian exportation towards European Union in 2005.

Therefore, the animal health situation of a country has become its main strength for market opportunities. The diseases concerned can be, for instance, Brucellosis, Tuberculosis, BSE, Scrapie, Avian Influenza, Blue Tongue, Nile fever virus, etc. One important issue for European animal markets in the following years will be its ability to apply its strong internal constraints of quality-traceability-sanitary guarantees-welfare or environment to its external suppliers (GEB, 2005).

Multiactivity

Even if multiactivity can reduce the technical productivity (Fiorelli *et al.*, 2005), it is often considered to be an important factor of sustainability in difficult areas. Ghersi (2002) considers that, in Southern Mediterranean countries, rural development should be based on multiactivity, rural tourism and craft industries. In those countries, small family-owned agro-food companies are supplying from 60 to 80% of the population.

In the French Eastern Pyrenean Mountains, with depopulated rural and Mediterranean areas, the setting-up of sheep farms is strongly linked to the subsidies of the Second EU Pillar, the diversification and the family multi-activities. This reinforces the need of global approach with human sciences and management methods (Pagès *et al.*, 2005).

Technology transfer from South to North

The technology uses to go from North to South around the Mediterranean Sea. However, the new wave of sustainable production systems promoted in Europe could have a better look at some extensive systems developed in the hard conditions of Southern Mediterranean countries. The global warming and the recent droughts in Europe could also be a signal for European animal farmers to look towards Southern adapted systems.

For instance, Algerian experiments have shown the positive effect of clay ingestion for lamb growth in Algeria (143 g, 169 g and 188 g of average daily growth for respectively 0%, 2.5% and 5% of added clay, Ouachem *et al.*, 2005). Pierre Bahri, developing a hyper sustainable agricultural system in the dry area of Ardèche in France, has brought some of his skills from his native Algeria. Therefore, technology easily migrates from North to South, but it also can move from South to North!

Conclusions

There is still an economic gap between Northern and Southern Mediterranean countries. But it is in a decreasing trend, particularly with some countries like Turkey or Morocco. One of Southern countries' main strengths is their populations with a growth usually over 2% per year. With such a rate, urbanisation is growing and, at the same time, so is the demand for meat in urban areas, where people can't slaughter and consume their own animal. This will certainly strengthen the meat industry and livestock farming in these countries, but also the trade between Northern and Southern countries.

In a study comparing some European sheep farmers' profiles, the sociological type of sheep farmers with regard to their "dynamism" has been found to have significant higher technical and economic efficiencies increasing, for example, the number of lamb per ewe, the stocking rate and even the gross margin per hectare (Dutertre, 2000).

Of course, very numerous technologies are available, easily crossing the borders. But, the dynamism of people, the presence of leaders and active farmers groups and the possibility for them to have the support of field technicians, will always be the best ways for efficient and sustainable development in both Northern and Southern Mediterranean countries.

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PIRINEOVI (INTERREG IIIA France-Espagne) analyse technico-économique des systèmes de production ovins viande des Pyrénées. Résultats préliminaires

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RESUME – Dans le cadre du programme INTERREG IIIA France – Espagne PIRINEOVI, les partenaires mettent en place un observatoire technico-économique dont l'objectif est de comparer les caractéristiques et les résultats de fonctionnement des systèmes d'élevage ovins viande de part et d'autre des Pyrénées. Ce travail amène à comparer les données techniques et économiques de 162 exploitations ovines de la zone frontalière (107 françaises et 55 espagnoles) pendant la période 2002-2004. La comparaison prend en compte les écarts de méthodologie dans la mesure des données, entre les deux pays. Cette première confrontation des résultats montre des différences notables à mettre en relation avec les modalités de gestion des élevages, en particulier sur la conduite de l'alimentation, la reproduction et la commercialisation. D'un point de vue économique, les écarts de résultats entre les deux zones sont compensés en partie par des politiques de structures et des niveaux de soutien à la production différents. Il s'agira dans les prochaines étapes de l'échange de préciser l'origine des différences et d'approfondir les modalités d'évaluation des postes de charges dans les gestions technico-économiques des élevages ovins viande.

Mots-clés : Systèmes d'élevage, ovin viande, gestion technico-économique, INTERREG IIIA France-Espagne.

SUMMARY – "PIRINEOVI (INTERREG IIIA France-Spain) Technical and economic analysis of meat sheep production systems in the Pyrenees (preliminary results)". In the context of the INTERREG IIIA France-Spain PIRINEOVI programme, the partners set up a technico-economic observatory whose objective is to compare the results and parameters of operation of sheep meat breeding systems on both sides of the Pyrenees. In this work, the evolution of the technical-economic data of a total of 162 farms of the border zone (107 French and 55 Spanish) during the period 2002-2004 (constant sample) is analysed. This first comparison of the results shows the considerable differences, in particular in relation to the modalities of management of breeding on the performance of supply, reproduction and marketing. From an economic point of view, the margins of technical performances between the two zones are compensated in part by levels of support to the production and for different markets for lambs. The next steps of the exchange will be to study further the method to assess the technical and economic management posts of meat sheep farming systems.

Keywords: Systems of breeding, ovine meat, management technico-economic, INTERREG IIIA France-Spain.

Introduction

Le programme Interreg IIIA France-Espagne PIRINEOVI consiste à établir un réseau d'observation et d'échange sur la production et la commercialisation de la filière agneaux des Pyrénées entre la France et l'Espagne. Il offre un cadre permettant aux partenaires issus du Nord de l'Aragón et de quatre départements français frontaliers (Hautes-Pyrénées, Haute-Garonne, Ariège et Pyrénées Orientales) de mettre en commun leur connaissance du fonctionnement technique, économique et humain de la filière ovine et d'en tirer des enseignements utiles pour optimiser le son fonctionnement.

Les partenaires du projet et les principales actions proposées sont détaillés dans le Tableau 1.

Tableau 1. Partenaires et actions principales du projet INTERREG IIIA France-Espagne PIRINEOVI

Partenaires	Actions
Unión de Productores Rasa Aragonesa (UPRA) - Grupo Carne Aragón	Construction de deux centres démonstratifs sur le pastoralisme, un sur le versant espagnol et un autre sur le versant fran ais, et exposition de toutes les races ovines des Pyrénées
Institut de l' levage. Service Actions Régionales Sud-Ouest / Toulouse	Comparaison de la gestion technico-économique des exploitations, systèmes d alimentation, gestion sanitaire des troupeaux et finition des agneaux dans les centres d engraissement
Coopérative Ovine des Pyrénées Orientales (COPO)	Bilan sociétal et économique des organisations de producteurs et coopératives
SOCOVIGAP	Mise en place d un observatoire commun des prix du marché de l agneau dans la région des Pyrénées
Union des Agriculteurs de Comminges (UAC)	Participation aux foires, conférences et voyages formatifs

Après le démarrage du programme en juillet 2005, les partenaires sont aujourd'hui en mesure de faire une première analyse comparative du fonctionnement des systèmes de production de viande ovine de part et d'autre de la frontière. Un des objectifs du programme est la création d un observatoire technico-économique et le développement d'une méthodologie commune pour évaluer et comparer le fonctionnement des systèmes de production d'ovins de viande des deux c tés des Pyrénées.

La gestion technico- conomi ue

La gestion technico-économique (GTE) répond plusieurs objectifs pour l'amélioration des performances de l'élevage ovin. Dans un premier usage, elle permet de fournir un appui technique l'éleveur par comparaison du bilan réalisé des typologies adaptées de références. Cela permet de mettre en évidence les points qui posent problème ou qui méritent des investigations plus précises dans le système d'élevage. Dans un deuxième usage, la GTE permet l'élaboration de références avec sa mise en place chez des éleveurs dont les performances sont jugées intéressantes. Elle apporte un certain nombre d informations et d explications sur la fa on dont les résultats sont obtenus, et dans quelles conditions. Au final, les programmes de GTE constituent une source d information pour les organismes de développement, les institutions administratives et le secteur ovin viande en général. Cette information est fondamentale dans les processus d'innovation et de transfert technologique.

Les méthodes de suivis technico-économiques développées de chaque c té du massif pyrénéen, s'appuient sur un socle commun qui assure la mesure des principaux facteurs constituants de la marge économique de l'élevage ovin viande : productivité, prix des agneaux, charges de productions en particulier alimentaires, aides la production et l'évaluation des critères techniques explicatifs.

Les méthodes mises en uvre s'appuient sur des concepts généraux de la GTE. Cependant, elles sont utilisées dans des contextes de structures et de fonctionnements totalement différents. En France, l'outil de travail en élevage est le sol, dont la valorisation est faite par les animaux (autonomie alimentaire, intensification fourragère), alors qu'en Espagne l'outil de travail est le troupeau dont la conduite est découplée de la ma trise foncière. Ces situations contrastées ont une forte incidence sur l'approche des co ts alimentaires, des charges foncières. Une autre différence réside dans l'appréciation des co ts de la main d' uvre familiale. Ces conventions mènent une approche considérablement différente de la marge économique dans les élevages ovins viande.

Mat riel et m thodes

L'observatoire technico-économiques mis en place dans le cadre du programme PIRINEOVI, s'appuie sur les données des suivis GTE d'un échantillon constant de 162 exploitations de la zone (107 des quatre départements fran ais et 55 aragonaises) sur la période 2002-2004.

Avant toute comparaison, il est nécessaire de prendre en compte les différences des critères d évaluation employés pour les suivis d'exploitations. Les principaux écarts résident dans le calcul de l'effectif moyen présent (EMP) d'animaux, ainsi que dans l'approche des charges alimentaires et de la main d' uvre familiale.

L'EMP

Dans les GTE espagnoles les indices techniques et économiques sont calculés par rapport un EMP qui intègre les femelles de plus de 12 mois. En France les mêmes indices sont calculés par rapport un EMP qui intègre les femelles de plus de 6 mois. Pour corriger ce biais, les données fran aises ont été ramenées des EMP avec agnelles prises en compte partir de 12 mois. Cette correction a entra né la diminution de l'EMP de l'échantillon fran ais par soustraction de la moitié du renouvellement. Cependant, cette règle des EMP 12 mois correspond mieux aux pratiques d'élevage de la zone PIRINEOVI o les premières mises la reproduction ont lieu couramment autour de 16 18 mois voire plus.

Les charges alimentaires

La GTE espagnole s'appuie sur un co t de la ration alors que les outils fran ais évaluent des charges de production fourragères. En Espagne, les produits de l'exploitation autoconsommés sont soit fournis la mangeoire, soit p turés par les animaux. Un prix de marché est affecté aux produits autoconsommés ou, quand celui-ci n existe pas, c'est le co t de production qui prime. En France, les produits cédés de l'exploitation l'atelier ovin, sont évalués au co t de production. Ce dernier intègre des co ts opérationnels des cultures et des surfaces fourragères (engrais, semences, etc.) et des co ts structurels de mécanisation (carburant, entretien et amortissement du matériel, b timent), tant pour la production que pour la distribution des aliments. Compte-tenu de ces conventions, la comparaison des charges de l'atelier ovin appara t hasardeux et par conséquent le calcul de la marge brute est difficile. Cependant, des confrontations poste poste sont possibles.

La main d' uvre familiale

En Espagne, la main d' uvre est une charge calculée de manière placer au même niveau de rémunération la main d' uvre familiale et la main d' uvre salariale. De plus, les charges sociales salariales et familiales sont affectées la rémunération du travail. A contrario, dans l'approche système développée en France la rémunération de la main d' uvre familiale n'est pas prise en compte dans les charges d'exploitation. En effet, le travail est considéré comme un facteur de production dont la rémunération se fait via le résultat courant. Les charges sociales de l'exploitant sont cependant prises en compte, de même que les charges liées l'emploi de salariés (salaire et charges sociales). Par conséquent, le choix a été fait de ne pas prendre en compte la rémunération de la main d' uvre familiale pour comparer les charges de l'exploitation.

La marge économique

L'approche économique des résultats des systèmes d'élevage ne permet d'aboutir dans les deux pays la même notion de marge d'exploitation. En France, la marge est calculée par différence entre l'ensemble des produits (ventes, aides, variations d'inventaires) et les charges opérationnelles. Le résultat obtenu est de type marge brute. En Espagne, les produits retenus sont identiques alors que les charges englobent au travers de conventions de calcul des charges opérationnelles et des charges de structure. Le résultat obtenu se rapproche de la marge nette.

Résultats et discussion

Les critères techniques

Les données moyennes des structures d'exploitation (Tableau 2) montrent que le nombre de femelles reproductrices dans les élevages aragonais est trois fois supérieur celui des élevages fran ais. En revanche, les élevages aragonais font appel 36% de main d' uvre supplémentaire par rapport aux fran ais. Au final, les éleveurs de la zone espagnole conduisent environ deux fois plus de brebis l'unité de travail humain (UTH).

Tableau 2. Données structurelles moyennes par exploitation (année 2004)

	Cheptel moyen (EMP 12 mois)	Unité de travail ovin (UTAo)	Cheptel / UTAo
Espagne	762	1,40	546
France	252	1,03	244

Ces différences trouvent leurs explications dans le niveau de spécialisation des élevages de part et d'autre de la frontière. En Espagne la production est liée des exploitations dont l'activité ovine est la seule source de revenu. Les systèmes sont spécialisés et pastoraux avec l'utilisation de zones faible potentiel alimentaire (système sec, système irrigué, système de montagne). En France, l'activité ovine est une composante de l'économie montagnarde. Les systèmes d'élevage sont souvent diversifiés avec des bovins, l'agrotourisme ou la vente la ferme. Les éleveurs pratiquent la pluriactivité avec un emploi non-agricole temps partiel. Les troupeaux spécialisés transhumants se trouvent surtout en zone de piémont ou de plaine.

Comme il a déj été indiqué, les éleveurs fran ais adaptent la taille du troupeau la surface fourragère disponible, en recherchant l autonomie alimentaire maximale. A l'opposé, les élevages aragonais ont recours autant qu'il est nécessaire des produits achetés, des locations de p turages ou l'utilisation de parcours communaux.

Malgré ces contextes différents, dans les deux zones, nous observons des croissances de cheptels identiques avec une main d' uvre par exploitation relativement stable sur cette courte période (Tableau 3). Il semble que l'augmentation des effectifs d'animaux est en partie liée l'attribution de primes l'unité de production (brebis) et non de l'unité produite (agneau). La stratégie d'amélioration ou de maintien des résultats présente des analogies fortes.

Tableau 3. volution des données structurelles (Indice 2002=100).

	2002	2003	2004
Cheptel moyen			
Espagne	100	103	103
France	100	103	107
UTAo			
Espagne	100	99	99
France	100	101	100

Sur les paramètres techniques des troupeaux (Tableau 4), nous observons une différence importante dans la productivité des brebis en faveur des exploitations aragonaises avec 0.41 agneaux de plus vendus par brebis en 2004 (renouvellement inclus). Cela s'explique par des performances de production en lien avec les systèmes d'élevage. Le taux de mise bas et la prolificité sont plus élevés dans l'échantillon espagnol. En effet, en Aragón la race la plus utilisée est la *Rasa*

Aragonesa avec certaines races prolifiques (Lacaune viande et INRA 401) présentes sur le territoire. Dans les quatre départements du sud-ouest de la France, la race rustique Tarasconaise prédomine. Le taux de mortalité des agneaux est identique dans les deux zones.

Tableau 4. Paramètres techniques moyens des élevages ovins viande de la zone PIRINEOVI (année 2004)

	Espagne	France
Taux de mise bas	1,20	0,87
Prolificité	1,37	1,23
Taux de mortalité	11,8	11,3
Productivité/brebis	1,45	1,04

L'écart le plus important est sur le taux de mise bas (0,33 points). Il est lié aux différences sensibles sur les modes de conduite de la reproduction. Les systèmes espagnols transhument peu avec des schémas de reproduction accélérés. De ce fait, le taux de mise bas dans l'échantillon est de 1,2 points. Côté français, les élevages essentiellement transhumants sont sur des schémas de reproduction à une mise bas par an, avec une repasse non systématique des brebis à la descente d'estive. Ces conduites extensives entraînent un taux de mise bas de 0,87, très voisin de la fertilité observée en race Tarasconaise.

L'analyse des paramètres techniques des troupeaux sur les trois années (Tableau 5), souligne l'évolution différente entre les zones de la productivité numérique : croissante en Espagne et décroissante en France. Cela est principalement dû à l'évolution des taux de mise bas. Les autres variables restent stables sur les trois années. Il est bon de rappeler que les deux échantillons sont de nature différente. Le réseau espagnol s'apparente à un réseau de références, alors que les résultats français sont issus de l'appui technique c'est-à-dire un ensemble d'élevages avec une maîtrise technique hétérogène.

Tableau 5. Évolution des paramètres techniques (Indice 2002=100)

	2002	2003	2004
Taux de mise bas			
Espagne	100	101	103
France	100	98	97
Prolificité			
Espagne	100	101	101
France	100	101	101
Taux de mortalité			
Espagne	100	100	103
France	100	105	98
Productivité			
Espagne	100	101	104
France	100	98	96

Les critères de production et commercialisation

La première analyse des données techniques de production (Tableau 6) montre que les types d'agneaux vendus sont différents de part et d'autre des Pyrénées. L'écart du poids moyen des agneaux vendus est de 10 kg en faveur de la France. Avec un poids moyen de 23 kg vifs, les éleveurs aragonais sont positionnés sur un marché d'agneaux légers dont la coopérative Oviaragón

assure la finition dans des centres collectifs en prestation pour l'éleveur. Ces agneaux sont commercialisés sous l'identification géographique protégée (IGP) *ernasco de Arag n*.

Tableau 6. Paramètres de production des élevages ovins viande de la zone PIRINEOVI (année 2004)

	Espagne	France
Productivité/brebis	1,45	1,04
Poids moyen agneaux vendus	23	33
Kilogrammes vendus/brebis	33,4	34,3

Dans les Pyrénées françaises, la production dominante est l'agneau léger maigre en lien avec les contraintes de cette zone (petites structures, bâtiments exigus, stocks limités, etc.). C'est une production qui répond à une activité finition en zone plus favorable. Les groupements de producteurs ont organisé la production dans l'objectif de retenir au maximum la plus-value liée à l'engraissement dans les éleveurs de la zone. Partout où les bâtiments et le système d'exploitation le permettent, ils encouragent la production d'agneaux lourds labellisés *Pyrénées – Garonne*. C'est le cas de la plupart des élevages suivis en appui technique.

Dans l'échantillon présenté ici, 80% des agneaux vendus sont des lourds. C'est pourquoi, le poids moyen des agneaux vendus est de 33 kg vifs. La mesure de la productivité en kilogramme de viande produite par brebis en 2004, montre un niveau relativement proche (0,9 kg de plus en France) entre les deux zones, malgré les 10 kg de différence du poids moyen des agneaux. Au final, c'est la productivité par brebis supérieure qui permet aux éleveurs aragonais de produire autant de quantité de viande par brebis avec un produit commercialisé en moyenne bien plus léger que dans l'échantillon français.

Les critères économiques

Les produits

Nous observons (Tableau 7) que les ventes et autres produits (laine, variations d'inventaire, etc.) par brebis sont supérieurs de 11 € dans l'échantillon aragonais. Le prix moyen des agneaux vendus est de 63 € en Espagne et 82 € en France. Cet écart important s'explique encore une fois par les types d'agneaux commercialisés. Il est logique que les agneaux lourds de l'échantillon français (80% des ventes d'agneaux) soient mieux payés à l'unité que les agneaux légers espagnols. Ramené au kilogramme vif, les agneaux espagnols sont payés aux éleveurs 0.,2 € de plus que côté français.

Tableau 7. Ventes moyennes des élevages ovins viande de la zone PIRINEOVI (année 2004)

	Espagne	France
Ventes et autres produits† (€)	86	75
Prix moyen des agneaux (€)	62	83
Poids moyen agneaux vendus (kg)	23	33
Equivalent agneau vendu / brebis	1,39	0,91
Kilogrammes vendus / brebis	33,4	34,3
Prix du kg d'agneau (€)	2,7	2,5

†Ventes des agneaux, des animaux de reproduction, des réformes, de la laine et variations d'inventaires.

Le produit total est supérieur de 28 € dans les élevages français. Cette différence est expliquée par le poids des aides d'accompagnement (Tableau 8). En Espagne les aides et primes représentent un peu plus du quart du produit total contre la moitié en France, soit 39 € de plus par brebis. Dans les aides et primes, une partie est commune aux deux zones de l'observatoire, c'est-à-dire 28 € par brebis comprenant la Prime Brebis Chèvre (PBC) et la Prime Spéciale (PS, ex Prime Monde Rural). La différence (Autres aides) s'explique par les aides de structure (Indemnités Compensatoires aux Handicaps Naturels, Mesure Agri-environnementale, Contrat Territorial d'Exploitation, aides sanitaire et génétique, etc.) qui sont issues de politiques différentes d'accompagnement de la production ovine.

Tableau 8. Composition du produit par brebis en 2004 (€)

	Espagne	France
Ventes et autres produits†	86	75
Aides et primes	35	74
PBC – PS	28	28
Autres aides	7	46
Produit Total	121	149

†Ventes des agneaux, des animaux de reproduction, des réformes, de la laine et variations inventaires.

Les charges

Compte tenu des approches très différentes dans l'évaluation des coûts, nous avons réalisé une comparaison avec un échantillon français réduit (réseaux de références, DIAPASON), pour lequel les données connues nous permettent d'appréhender l'ensemble des coûts opérationnels et de structure en rapport avec l'activité.

L'observation des coûts totaux par brebis (Tableau 9), fait apparaître des différences importantes. En effet, l'écart est de 27,67 € de plus dans les exploitations françaises, essentiellement dû aux coûts généraux plus élevés en France. Le poste coûts généraux fera l'objet d'investigation plus approfondi dans les suivis d'exploitations mis en place en 2005 et 2006.

Tableau 9. Charges totales par brebis en 2004 (€)

Charges	Espagne	France
Alimentation	51,71	54,56
Reproduction - sanitaire	3,61	3,94
Achats d'animaux	0,95	2,08
Sécurité sociale et main d'œuvre salariée	8,97	12,36
Coûts généraux	11,69	31,66
Totaux	76,93	104,60

Ce poste présente une composition variable selon les deux zones de l'Interreg. En Espagne, les coûts généraux intègrent les coûts de commercialisation, les quotes-parts coopérative et associations, les assurances, la tonte, le transport, l'eau, l'électricité, le carburant, les réparations et entretiens, les coûts de la transhumance, les loyers et les annuités. En France, les coûts généraux intègrent les impôts et taxes, les assurances, la location, l'entretien et l'amortissement du foncier, les coûts de commercialisation, l'électricité, l'eau, les frais de gestion comptable et le transport.

Les autres postes de charges présentent des niveaux similaires pour les coûts sanitaires et de

reproductions ainsi que pour les coûts d'alimentation, malgré les différences méthodologiques pour la détermination de ces derniers.

Il est à noter que le poste *charges d'alimentation* représente 67% en Espagne et 52% en France des charges totales de l'exploitation. Par conséquent, les résultats du Tableau 10 présentent une analyse plus fine de ce poste, en tenant compte des différences de zones déjà abordées concernant la conduite des systèmes d'élevage. Ainsi, en Espagne l'alimentation achetée pèse 66% du coût alimentaire total contre 37% en France. En revanche, en France l'alimentation autoconsommée et ses charges assimilées (charges des surfaces + mécanisation) représente 63% du coût alimentaire total.

Tableau 10. Répartition du coût alimentaire total (année 2004)

	Espagne		France
Coût alimentaire total	51,71 €	Coût alimentaire total	54,56 €
Aliments achetés pour brebis	37%	Concentré acheté	32%
Aliments achetés pour agneaux	29%	Fourrage acheté	5%
Autoconsommation en mangeoire	17%	Charges des surfaces	20%
Autoconsommation au champs	6%	Mécanisation	43%
Location de pâtures	12%		

Enfin, nous soulignons aussi les locations de pâtures qui représentent 12% des coûts d'alimentation dans les exploitations aragonaises. Il s'agit de locations précaires mises en place avec d'autres agriculteurs de la région ou les collectivités territoriales locales.

Conclusion

En conclusion, ce premier essai de confrontation des résultats techniques et économiques transfrontaliers de l'élevage ovin viande des Pyrénées fait apparaître des similitudes et des écarts notables. Les écarts des résultats techniques observés, seront approfondis dans les études thématiques du programme d'échange. En effet, les organismes partenaires souhaitent travailler sur les thèmes du suivi sanitaire des troupeaux, la finition et la commercialisation des agneaux. Du point de vue des résultats économiques, les postes de produits sont bien identifiés de part et d'autre pour faciliter les comparaisons. Pour les postes de charges, les travaux futurs doivent nous permettre d'approfondir l'approche différente de ces critères pour affiner les résultats précédents. Il s'agira sur la période 2005 à 2007 de suivre selon la même méthodologie plusieurs systèmes d'élevage sur l'ensemble de la zone PIRINEOVI.

Sustainable development of mixed farming systems in a newly reclaimed area in Egypt

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SUMMARY – A linear programming (LP) technique was adopted to determine the optimum combination of crops and livestock production on small mixed farms in a newly reclaimed area in Egypt. Three locations reflected the different types of producer traditional farmers, early retirees, and university graduates. One LP model with two scenarios was proposed. The base run (real-life situation) utilized farm available production resources of crop and livestock activities. The first scenario (LP1) was proposed to meet farmer's basic food needs and satisfy animals requirements under the constraint of availability of Egyptian Pounds LE 10,000 as cash resources. The second scenario was the same as LP1 structure but modifying the farm size in the three studied locations to 10 feddan. It could be recommended that 10 feddan as farm size plus about 6 animal units with no less than 10,000 LE as cash resources is a reasonable structure for the development of the small mixed farm system in newly reclaimed areas in Egypt.

Keywords: Linear programming, gross margin, mixed farming, simulation.

R SUM **–** "Développement durable de systèmes agricoles mixtes dans une zone nouvellement mise en valeur en Egypte". Une technique de programmation linéaire (LP) a été adoptée afin de déterminer la combinaison optimale pour la production des cultures et de l'élevage sur de petites exploitations mixtes dans une zone nouvellement mise en valeur en Egypte. Trois localités ont représenté les différents types of producteurs : fermiers traditionnels, retraités récents, et diplômés universitaires. Un modèle de LP avec deux scénarios a été proposé. L'exécution initiale (situation réelle) utilise les ressources disponibles à la ferme - production des cultures et de l'élevage. Parallèlement, un premier scénario (LP1) a été proposé pour répondre aux besoins des agriculteurs en aliments de base et en même temps pour satisfaire les besoins des animaux sous une contrainte de trésorerie de 10 000 livres égyptiennes disponibles. Le second scénario reprenait la même structure que LP1 mais en modifiant la taille de la ferme dans les trois localisations étudiées, pour l'amener à 10 feddans. Les recommandations ont été de 10 feddans comme taille de l'exploitation et environ 6 unités animales et pas moins de 10 000 LE comme trésorerie, comme structure raisonnable pour le développement d'un système de petites fermes mixtes dans les zones nouvellement mises en valeur en Egypte.

Mo s s : Programmation linéaire, marge brute, agriculture mixte, simulation.

Introduction

In Egypt, about two million feddan (1 feddan = 4200 m^2) are classified as newly reclaimed area. This newly reclaimed area is sandy or saline soils recently recovered or rehabilitated for agricultural production (MOA, 2002). Mixed farming system, practicing both crop and animal production, represent the dominant farming system in most developing countries. The production of small-scale mixed farms is still low and would be raised to adequate standards to generate satisfactory income. This could be achieved by developing the skills of farmers and providing them with effective technologies to enhance the utilization of their limited resources.

The sustainability of agricultural production in newly reclaimed areas is constrained by many limiting factors. Farmers usually look for the best possible way for allocating their limited production resources among cropping and livestock activities. Moreover, farmers always seek on optimal mix of farming activities that maximizes their income. Farmers, often, follow their instinct and experience to handle this problem. Instinct and experience do not guarantee optimal results, however, linear programming models and simulation techniques offer a powerful and useful tool that can help farmers and assist the decision-maker in choosing the most efficient way to allocate scarce resources and to achieve a certain number of goals in order of their priority.

This study adopted linear programming (LP) and simulation techniques to evaluate the current small-scale mixed farming system in the newly reclaimed area in Egypt and investigate the impact of different proposed policy scenarios on the overall efficiency of the current mixed farming system.

Materials and methods

The study area

This study was carried out at South Tahreer Province. It is located in the west of Nile Delta at 120 km north west of Cairo between longitudes 30° 57' E and 30° 41' E and latitudes 29° 55' N and 29° 25' N. This area contains a variety of small-scale mixed farming systems of different farm size and type of farmers. Three locations were identified: (i) location 1, where the farmers were traditional settlers and the average farm size was 4.6 feddans; (ii) location 2, where farmers were mainly early retirees and the average farm size was 13.8 feddans; and (iii) location 3, that included university graduates and the average farm size was 15.4 feddans.

Data

A random sample of 155 farms was obtained. A questionnaire was designed to identify available production resources, animal and crop production performance, variable costs, and gross outputs. These data were collected during the agricultural year October 1995 to September 1996. Activities were wheat, berseem (*rifolium alexandrinum*), groundnut, maize and livestock products (milk, meat and manure) named X_1, X_2, X_3, X_4 and X_5, respectively. Livestock was measured in animal unit (AU) according to Barnard and Nix (1993).

Data analysis

The data were analysed by least squares techniques using General Linear Model Procedure (SAS, 1998). The fixed effects linear model was used to analyse production resources and to develop technical coefficients of crop and livestock activities and level of inputs needed for each activity.

Farm budget was prepared (Table 1), including gross outputs, variable costs and gross margin. Variable costs for crops included labour, mechanical power, fertilization and seeds. Also, variable costs for livestock activities included labour, green fodders, concentrates, veterinary care. Technical coefficients derived from statistical and farm budget analyses were used in building up the simulation models.

Farm model structure

The general mathematical formula of the linear programming model used to simulates the behaviour of the current farming system (real-life situation) which is called base run and proposed policy scenarios in the three locations based on Quantitative System Business (QSB, 1987) software was as follows:

Objective function:

$$\text{Maximize (gross margin)} = \sum_{i=1}^{5} a_i X_i,$$

where: a_i = gross margin per unit for each variable of X_i ; X_i = number of feddans cultivated with wheat (X_1), berseem (X_2), groundnut (X_3), maize (X_4), and number of animal units (X_5).

Subject to:

- Land: $X_1 + X_2$ = average farm size (winter crops)
  $X_3 + X_4$ = average farm size (summer crops)

- Labour:

$$\sum_{i=j=1}^{5} c_j X_i \leq b,$$

where: c_j = number of units of man/day required for each commodity b = maximum units of man/day available and $_i$ as mentioned before.

- Available cash resources:

$$\sum_{i=j=1}^{5} d_j X_i \leq m,$$

where: d_j = variable costs for each variable $_i$ m = available cash resources and $_i$ as mentioned before.

- Non negativity:

$$_i _ 0, \quad i = 1, \quad .,5$$

Table 1. Gross outputs (GO), variable costs (VC) and gross margins (GM) in LE† (Egyptian Pounds) per feddan and per animal unit for the studied locations

Variables	GO††	VC††	GM
Location 1			
Winter crops			
Wheat	785	420	365
Berseem	720	186	534
Summer crops			
Groundnut	1165	497	667
Maize	644	378	266
Livestock	1078	309	769
Location 2			
Winter crops			
Wheat	423	202	221
Berseem	720	152	568
Summer crops			
Groundnut	478	406	72
Maize	229	130	99
Livestock	933	439	494
Location 3			
Winter crops:			
Wheat	394	330	64
Berseem	720	274	446
Summer crops			
Groundnut	645	537	78
Maize	292	359	-67
Livestock	1212	364	848

† 1 Euro = 7.5 LE.

†† The marked differences in GO and VC among the three studied locations were due to the different production resources available in each location, in addition to management practices in each location.

Proposed policy scenarios

The study propose different government policy scenarios to sustain and enhance the overall efficiency of the current farming system, namely: (i) fulfil family's consumption of essential food (wheat and maize) in addition to using on-farm feeding resources to satisfying animal's requirements and an availability of 10 000 LE as cash resources (LP1); and (ii) the second scenario (LP2) was similar to LP1 in addition to adjust average farm size to be 10 feddan for each farmer in the studied area.

Results and discussion

Base run solution

Results of base run (real-life situation) that simulate the behaviour of current situation for the three studied locations are shown in Table 2. The base run solution revealed that, in order to maximize the farm income, farmers have to change their management practices of the current cropping pattern to be 3.25, 2.32 and 2.22 feddans of berseem in winter, and 2.32, 4.12 and 2.43 feddans maize in summer, along with 1.61, 1.14 and 1.37 animal units in the three studies locations, respectively. The proposed areas cultivated with berseem in winter, represented about 71%, 17% and 14% and those cultivated with maize in summer represented about 50%, 31% and 16% of farm size, in the three locations, respectively. The obtained results are not comparable with the real-life situation, this may due to high variable costs of cultivating wheat and groundnuts and higher gross margin of selected crops (berseem and maize). Livestock activity was found as a competitive activity with cropping. Herd size was small due to the limitation of cash resources.

The obtained results support the concept concluded by Bhatia and Gangwar (1981) that, farmers have different goals other than just maximizing their farm income. Also, Abdulkadri and Ajibefun (1998) suggested that farmers could have socio-economic objectives other than profit maximization like family satisfaction and diversification of strategic crops to avoid market risk. To deal with market risk problems many researchers (e.g. Charnes and Cooper, 1958; Madansky, 1962; Charnes and Cooper, 1963; Bawa, 1973; El-Shishiny and Attia, 1985; El-Shishiny, 1988; Rodríguez and Anderson, 1988) introduced various stochastic or multi-objective modelling techniques farm planning to avoid uncertainty problems.

Proposed scenarios solutions

The first scenario (LP1) was proposed mainly to reduce market risk due to cultivating only one type of crops obtained from base run solution and to satisfy farmers' basic needs, i.e. an attempt for farm self-sufficiency. Applying the LP1 scenario in the three studied locations revealed that there was no feasible solution for the location 1. This result could be due to the small farm size of location 1 (4.6 feddans).

The optimal LP1 solutions for locations 2 and 3 are presented in Table 2. The optimal LP1 solutions proposed that, farmers should cultivate 12.32 feddans wheat and 1.48 feddans berseem in location 2 and 11.53 feddans wheat and 1.86 feddans berseem and leave 2.01 feddans fallow in location 3 in winter. While, in summer, farmers should cultivate 2.43 feddans groundnuts and 11.37 feddans maize in location 2 and one feddans groundnuts, 5.6 feddans maize and leave 8.8 feddans fallow in location 3, along with 9.03 and 8.6 animal unit in the locations 2 and 3, respectively. The total crop area proposed by LP1 in location 3 is smaller than total farm size due to the limiting cash resources which led to not cultivating all farm size and leaving some fallow.

The optimal LP2 solutions for the three studied locations are shown in Table 2. The optimal LP2 solutions suggested that, farmers should cultivate 8.99, 8.5 and 9 feddans wheat and 1.01,1.5 and 1 feddans berseem in the three locations, respectively, in winter. While, in summer, farmers should cultivate 1, 7 and 1 feddans groundnuts and 9, 3 and 8 feddans maize in locations 1, 2 and 3, respectively. Moreover, the solution suggested that farmers in location 3 could leave one feddan fallow.

Table 2. Real-life situation, base run and proposed scenarios solutions of the three studied locations

Item	Real- life situation	Base run	LP1	LP2
Location 1				
Cropping pattern (feddan):				
Winter				
Wheat	1.95	---	No feasible solution	8.99
Berseem	1.65	3.25		1.01
Summer				
Groundnuts	3.05	---		1.00
Maize	1.39	2.32		9.00
Livestock production (animal units)	2.32	1.61		6.60
Location 2				
Cropping pattern (feddan)				
Winter				
Wheat	4.10	---	12.32	8.50
Berseem	2.67	2.32	1.48	1.50
Summer				
Groundnuts	4.85	---	2.43	7.00
Maize	2.33	4.10	11.37	3.00
Livestock production (animal units)	2.40	1.14	9.03	6.40
Location 3				
Cropping pattern (feddan)				
Winter				
Wheat	3.32	---	11.53	9.00
Berseem	2.35	2.22	1.86	1.00
Summer				
Groundnuts	4.41	---	1.00	1.00
Maize	1.65	2.43	5.60	8.00
Livestock production (animal units)	2.84	1.37	8.60	6.50

The result of LP2 solution for livestock activity was 6.6, 6.4 and 6.5 animal units in the three studied locations, respectively. These results show that the limitation of small farm size in location 1 in the LP1 constrained the farmers for using the high amount of the available cash resources to improve their farm income. While, in location 3, the cropping pattern was changing but as in the same trend as LP1 and the 8.8 feddan of fallow area obtained in LP1 in summer was decreased to 1 feddan in LP2. The number of animal units in this scenario was nearly the same in the three studied locations. This result indicated that livestock activity was not competitive with cropping activity, because, decreasing the farm size from 13.5 and 15.4 feddan in location 2 and 3, respectively to 10 feddan led to decrease the livestock activity. Moreover, the cultivated area in location 3 was increased from 6.6 feddan in LP1 to 9 feddan in LP2 during summer season.

Economic indicators

The gross margin per farm and return per unit of production resources (per feddan and animal unit) were used as economical indicator for the system efficiency. Base run solution revealed that the gross margin per farm was improved with value of 55%, 26% and 42% more than real-life situation in the three locations, respectively (Table 3). Gross margin in location 1 was the highest among of the three locations. This could be due to type of farmers who have more experience than the other farmers in the other two locations, small farm size made farmers use most available resources in their farms. These results in agree with other findings in previous studies as those conducted by, Siam, et al. (1994), Ahmed (1995), Ahmed et al. (1996), Mahmoud (1997) and Alsheikh et al. (2002).

Table 3. Economical indicators of the real-life situation and simulation models of the three studied locations (LE)

Item	Real-life situation	Base run	LP1	LP2
Location 1				
Gross margin/farm	2919	4524		12132
Return / feddan	635	983		1213
Return / animal unit	1258	2810		1838
Location 2				
Gross margin/farm	1730	2179	8638	6476
Return / feddan	128	161	640	648
Return / animal unit	720	1911	957	1012
Location 3				
Gross margin/farm	1654	2347	9361	7299
Return / feddan	107	151	608	730
Return / animal unit	582	1713	1088	1123

Applying the first scenario (LP1), the results showed that the gross margin per farm can be improved by 296% and 299% more than base run in the locations 2 and 3, respectively (Table 3). These high percentages could occur due to different available cash resources between base run and LP1. While, the difference between the two percentages indicated that farmers in location 3 were slightly more efficient than that in location 2. This difference could obtained due to slight differences on farm size between the two locations (13.8 vs 15.4).

The values of gross margin obtained in LP2 were improved to 12132, 6476 and 7299 LE in the three studied locations, respectively. This result confirmed that the farmers of location 1 were more efficient than the other two locations, because they used their own production resources economically and not due to small farm size only.

The return per feddan was improved about 55, 26 and 41% in base run compared to the actual situation in the three locations, respectively. While, the return per feddan in LP1 was improved about 297% and 303% compared to base run in the locations 2 and 3, respectively. This result could be supported the same result obtained in the first economical indicator. While, in the LP2, the return per feddan was improved 1% and 20% in locations 2 and 3 respectively. This result indicated that decreasing the farm size to 10 feddan did not affected strongly the return per feddan.

The return per animal unit was improved by about 123, 165 and 194% in base run compared to the real-life situation in the three locations, respectively. These high percentages could occur due to a theoretical assumption: that the farmers in the three locations already have the animals. Anyhow, these percentages indicated that there was an observed result against that obtained in the first and second economical indicators, which suggested the farmers in location 1 were more efficient than those in the other two locations, in addition to increasing farm size to 10 feddan and soft loan of LE 10,000. This result is due to the fact that farmers in the other two locations prefer livestock activities than cropping activities. While, the return per animal unit in LP1 was decreased about 100% and 57% in the locations 2 and 3, respectively. This result could occur because the farmers in location 2 cultivated 13.8 feddan in both winter and summer seasons in LP1 vs 2.32 feddan in winter and 4.1 feddan in summer in the base run solution. Also, this result could occur due to the small number of the animal units obtained from base run solution (1.14 animal units in location 2). The same trend was occurred in location 3. This result also supported that farmers in the other two locations could prefer livestock activities than cropping activities, because they kept high number of animal units (9.03 and 8.6 animal units in location 2 and 3, respectively) and leaves some fallow.

Applying LP2 scenario revealed that the return per animal unit decreased in comparison with results of base run to values of 1838, 1012 and 1088 LE, in the three studied locations, respectively. This result may be due to the increasing number of herd size recommended by the optimal solution. In

general, the return per animal unit under both real-life situation and the proposed two scenarios was higher than the return per feddan.

It could be recommended that, 10 feddan as farm size plus about 6 animal units with not less than 10,000 LE as cash resources is a suitable structure for developing the small-scale mixed farming system in newly reclaimed areas in Egypt.

Conclusion

Results of the present study revealed that simulation and linear programming techniques provide full information about the impact of the proposed policy on farm income before implementation. It is of a great interest to notice that response of different proposed scenarios has not the same impact on farm income in the studied area. This could be attributed to the differences of production resources and management practices among the studied locations. The proposed models are a valuable planning tool formulated to assist decision-makers in evaluating alternative policy for sustainable development of newly reclaimed areas in Egypt.

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Perspectives de la production ovine au Maroc

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RESUME – L'élevage du mouton est une activité importante au Maroc. Sa prédominance à travers le Royaume découle de son adaptation à la majorité de ses agro-écosystèmes qui est due à la biodiversité de ses races d'une part et à sa flexibilité en tant qu'unité de production par rapport au contexte socio-économique et foncier du Maroc d'autre part. Le futur de cet élevage est à la merci de ses propres performances technico-économiques, de son impact sur les ressources naturelles et du modèle de consommation projeté des viandes rouges. Le futur de la production ovine n'est donc pas clair surtout lorsqu'on prend en considération l'ouverture du marché marocain à certains produits animaux et aliments à des prix très compétitifs. Aussi des actions en matière de politiques de l'Etat, d'organisation des producteurs et de soutien à la recherche et au transfert de ses résultats s'avèrent plus que nécessaires afin d'assurer la mise à niveau de la filière.

Mots-clés : Ovin, compétitivité, ouverture du marché, durabilité, Maroc.

SUMMARY – *"Perspectives of sheep production in Morocco". Sheep husbandry is an important activity in Morocco, due to its adaptation to the majority of the existing agro ecosystems. Sheep adaptation stems from the biodiversity od breeds and from its flexibility as a production unit in relation to both the socio economic and the land tenure contexts. he future of sheep raising activity ill depend on its technico economical performances, on its impact on the natural resources and on consumers' trend for mutton consumption. Based on these conditions, the prospects of the sheep sector are not clear particularly hen one takes into account the free trade agreements signed by Morocco and hich ill allo some animal products and feeds to enter Moroccan markets at very competitive prices. It is therefore very critical that the government puts together policies that ill assist the sector in these difficult times (i.e. supporting producers' organi ations, strengthening, research and technology transfer related to sheep production, etc.).*

Keywords: *Sheep, competitiveness, market liberalisation, sustainability, Morocco.*

Contexte de la production

La croissance démographique au Maroc comme le déficit céréalier et l'augmentation des prix mettent l'accent sur la nécessité d'une augmentation de la productivité. Dans la plupart des pays qui ont connu la Révolution Verte dans les années 70, se sont mises en place des politiques d'accompagnement en matière de subventions pour faciliter l'adoption technologique. Mais force est de constater le relatif échec du transfert technologique auprès des exploitations des zones arides et semi-arides qui ne bénéficient pas d'irrigation.

Les conséquences de cette politique sur le secteur de l'élevage en général et sur l'alimentation animale en particulier sont comme suit:

(i) le déplacement de la culture de l'orge vers les zones pastorales ;

(ii) la mise en culture des meilleures terres pastorales ;

(iii) une contribution à la diminution des superficies des légumineuses ;

(iv) la stagnation des superficies des cultures fourragères, qui n'ont pas dépassé les 400,000 ha ;

(v) l'alimentation des ruminants qui utilise principalement la paille (un grand sous-produit des céréales) comme ration de base ce qui constitue un handicap à l'intensification des productions animales.

Il faudrait ajouter cela l'attitude des producteurs face au risque. En général, les chefs d'exploitation dans les zones difficiles s'opposent au risque ne pouvant supporter de larges variations en dépenses et revenus. De plus, le capital terre constituerait selon les constats de plusieurs recherches un frein l'adoption de nouvelles technologies. Ceci est notamment le cas dans les systèmes de production pastoraux et agro-pastoraux statut collectif.

Comp titivit de la production

Produire de la viande ovine pour le marché local ou étranger doit se faire en ma trisant les co ts afin d'assurer une certaine compétitivité par rapport d'autres types de viandes. Il est évident que l'ouverture de notre marché des produits animaux et l'alimentation animale venus d'ailleurs mettra davantage l'accent sur la compétitivité de nos modes de production.

A défaut d'observatoire technico-économique de nos élevages ovins dans leurs différents systèmes de production, on pourrait regarder ce qui se passe dans des pays de la rive nord de la Méditerranée. En effet, même dans des climats plus cléments que le n tre et avec des niveaux de dégradation des ressources pastorales nettement moindres, l'observatoire installé dans un certain nombre de pays montre que beaucoup d'élevages ne sont pas viables économiquement (FAO/CIHEAM/CIRVAL, 2002). Avec des troupeaux réduits et des quantités produites insuffisantes, ces systèmes ne permettent pas de générer suffisamment de revenu même avec des niveaux de prix élevés.

Cependant, le constat d'une insuffisante rentabilité économique ne permet pas d'expliquer l'évolution des systèmes de production. On pourrait alors, selon la seule logique de rentabilité, être amené prédire la disparition de systèmes de production qui s'avèrent paradoxalement plus robustes et résistants. La réalité sociologique a en effet une forte influence sur la résistance de ses systèmes dans lesquels prédominent encore des rapports non commerciaux entre les acteurs et vis- -vis des ressources naturelles disponibles. Des approches autres que strictement économiques doivent alors être empruntées sur la base de propositions techniques "sociologiquement acceptables" pour introduire des éléments de changement et d'innovations nécessaires la durabilité des systèmes plus long terme.

Dans une étude qui avait comme objectif le calcul des indices d'efficience technique et économique des producteurs qui intègrent la céréaliculture et l élevage dans une région semi aride du Maroc, Boughlala (1998) a tiré les conclusions suivantes :

(i) les producteurs de ces régions ont un niveau d'efficience technique élevé. Ce résultat signifie que moyennant les technologies disponibles, l'affectation des ressources se fait dans les normes de la rationalité

(ii) l'indice d'efficience économique reste cependant faible.

A la lumière de l'analyse des facteurs qui déterminent le niveau d'efficience de ces exploitations, l'auteur avance que :

(i) l'amélioration de l'efficience économique passe par l'amélioration des conditions d'acquisition des intrants (prix, qualité, circuit de commercialisation). A ce titre, l'encouragement des coopératives d'approvisionnement pourrait améliorer l'efficience économique

(ii) l'amélioration de l'environnement institutionnel en facilitant les conditions d'accès au crédit agricole, pourrait être l'origine d'une meilleure efficience économique.

Par ailleurs, afin d'illustrer la cherté de la viande ovine au Maroc, il suffit de se rappeler qu'il faut huit heures de travail d un salarié (au salaire minimum) pour se procurer un kg de cette denrée. Cette durée est de 12 et 11 heures respectivement en Algérie et en Tunisie (INRA-ICARDA-FEMISE, 2004). Une autre évidence la cherté de cette viande est le rapport de son prix (au kg) celui du prix d'un kg d'orge, qui est de 38.

uelle place pour les ovins a cote des autres ruminants ?

Par leurs caractéristiques biologiques les ovins et les caprins sont bien adaptés aux conditions méditerranéennes. Plus particulièrement, la brièveté relative (vis- -vis des bovins) de la durée de la gestation et de la période de la lactation leur assure une certaine capacité d'ajustement aux cycles annuels du climat dans des conditions d'élevage extensif et semi-extensif. Ces conditions déterminent d'importantes alternances annuelles et interannuelles d'abondance et de pénurie des ressources alimentaires spontanées (parcours, jachère) et d'origine agricole (paille, chaumes, grains). Leur petit format leur confère des exigences alimentaires individuelles réduites et des possibilités de déplacement sur des espaces qui seraient inaccessibles pour les bovins.

Ces deux espèces de petits ruminants sont respectivement pourvoyeur de laine et de poils dont l'utilité n'est pas démontrer au niveau des exploitations par le bais de l'autoconsommation et par une valorisation sur le marché.

La bataille entre l'ovin et le caprin se jouera sous deux angles :

(i) le fait que la chèvre est considérée tort ou raison comme destructrice de la nature donne un avantage objectif ou subjectif l'élevage du mouton

(ii) les qualités nutritionnelles et diététiques dévolues au caprin, auront certainement un effet négatif sur l'élevage du mouton.

En arrière plan, on ne doit pas oublier le r le culturel que représente l'ovin dans les traditions marocaines (fêtes du sacrifice, et autres fêtes) qui priori laisse supposer un r le prépondérant de son élevage au Maroc. Dans cette perspective, l'option de l'exportation des ovins vers un marché extérieur demandeur de différents types d ovins (ovins bio, ovins cornes) n'est pas exclure non plus.

L'existence de risques climatiques importants conduit mettre en place plusieurs productions pour mieux faire face aux conséquences de l'irrégularité du climat. L'élevage a le grand avantage de pouvoir valoriser des cultures qui, ayant souffert de la sécheresse, auraient été perdues, si le seul produit final avait été le grain. A l'extrême, dans les zones arides, l'animal tend accentuer les effets négatifs de la sécheresse sur la végétation (cas des parcours steppiques et semi-désertiques).

D veloppement de nouvelles niches de production

La diversité des systèmes de production ovins exige des stratégies de développement nuancées. En effet, si la tendance actuelle privilégie fortement, comme pour les autres secteurs de l'agriculture, une vision du progrès dans lequel prédomine l'augmentation des performances zootechniques, elle tend diminuer la diversité des systèmes de production et atténuer la spécificité des produits ovins qui peut être une niche porteuse.

Traditionnellement, la viande ovine est consommée en rago t ou en sauce, c'est dire après une préparation cuisson humide longue. Depuis peu, les gigots et les épaules r tis commencent appara tre chez les familles aisées lorsqu'elles re oivent, et les grillades de c telettes ou de tranches de gigot sont de plus en plus fréquentes dans la restauration commerciale, en ville ou au bord des routes. Ces modes de préparation exigent une viande plus tendre, d'o la tendance l'abattage d'animaux plus jeunes (= plus légers). La tendreté varie aussi selon les différentes parties de la carcasse, ce qui explique la découpe anatomique de plus en plus pratiquée par les bouchers. Des recherches menées l'INRA ont montré que composition de la teneur de la carcasse en graisses et la part des différents morceaux de peuvent être changées par le croisement et la conduite alimentaire. En effet des croisements mis au point en station peuvent favoriser une diminution de la teneur en graisse des carcasses et favoriser le développement des morceaux dits "nobles", ce qui est, de nos jours, de plus en plus demandé.

Cette nouvelle tendance vers une segmentation selon les types d'animaux, ou les morceaux de la carcasse, ne peut être correctement transmise jusqu'aux producteurs (différenciation par les prix notamment) que si de nouveaux outils réglementaires et/ou institutionnels sont mis en place pour

conna tre et faire reconna tre, aux consommateurs et aux producteurs, la qualité des produits ovins et leur valeur.

La demande pour une viande spécifique (terroir, race) n'est pas l'ordre du jour pour la consommation quotidienne. Par contre, ces préférences s'expriment avec vigueur l'occasion de l'Aid ou l'occasion de l'achat d'une offrande ou d'un sacrifice pour une fête. Au Maroc, le différentiel de prix l'occasion de la fête du sacrifice peut atteindre 30% par rapport au prix moyen au cours de l'année. A ce titre, les moutons cornes sont les plus recherchés et les plus prisés. Cet évènement nécessite des études multi-disciplinaires en vue d'appréhender son impact réel sur l'évolution de l'élevage ovin et ses retombées sur l'économie rurale en général et de celle des exploitations et leurs systèmes de production en particulier.

Par ailleurs, il n'est pas exclu que le Maroc pourrait se situer en position d'exportateur d'ovins si un plan de mise niveau de ce secteur (production et marketing) est lancé l'avenir. Le sondage d'une telle demande, de ses exigences et de ses implications sur les modes de production offre un champs d'investigation caractère multi-disciplinaires

uelle opportunit pour une intensification de la production ovine ?

La dynamique et l'évolution des systèmes de production dépendent de leur capacité adopter les bonnes innovations. Celles-ci leur permettent de ne pas se figer dans un immobilisme qui loin d'être synonyme de tradition, les condamnent la marginalisation voire la disparition. A ce titre, on pourrait prendre comme exemple d'innovations, la sélection en races pures au sein des systèmes de production extensifs et le recours des races exotiques productives dans le cadre de croisements avec des races locales dans des systèmes de production intensifiés.

Le scénario de l'extensification pour les systèmes pastoral et sylvo-pastoral (zones marginales) existe. Dans ces zones, la densité de la population, la productivité et l'investissement sont faibles et le développement rural semble être plus difficile en comparaison avec d'autres zones. Dans ce scénario, il se peut que certaines régions marginales puissent avoir des caractéristiques spécifiques et par l posséder un avantage comparatif par rapport d'autres (voisinage de grands centres urbains, existence de paysages valeurs touristiques, disponibilité de certains produits spécifiques, existence de certaines infrastructures de base, existence d'une petite industrie,). Ce contexte induira le développement de la pluriactivité et pourra éventuellement maintenir les gens sur place avec une activité dans les trois secteurs de l'économie. Au sein de ce scénario, il existe plusieurs variantes en fonction de la taille des élevages et de leur niveau d'ouverture sur le marché (logique de subsistance, paysanne et commerciale).

Le scénario de l'intensification avec le développement de grandes et moyennes exploitations vise l'augmentation de la productivité. Ce système peut induire le développement d'une infrastructure et de l'emploi plusieurs niveaux de l'économie. Ce scénario pourra terme poser des problèmes d'ordres environnemental et socio-économique.

L'analyse de la production ovine dans ces différents systèmes de production indique que notre production moutonnière est majoritairement extensive (systèmes pastoraux et sylvo-pastoraux) semi-extensives (systèmes agro-pastoraux). Même en l'absence de statistiques chiffrées sur cette qualification, les effectifs ovins élevés, les espaces occupés et la prévalence de l'activité des modes de production corroborent de manière éloquente ce constat. La conduite des troupeaux et les performances réalisées attestent d'une désarticulation au niveau du fonctionnement global de ces deux systèmes (sédentarisation de plus en plus prononcée sur les parcours, dégradation omniprésente de la flore et des sols, recours massif aux concentrés, mouvements de plus en plus prononcés d'animaux jeunes vers des conduites intensives, faible part des cultures fourragères dans le calendrier alimentaire).

Plusieurs propositions techniques ont été faites pour réhabiliter le caractère extensif et semi extensif de l'élevage ovin marocain. L'adoption et l'efficacité de ces propositions supposes certains préalables : (i) des moyens publics conséquents (ii) une adhésion des producteurs aux principes de ces interventions et leur participation leur mise en uvre dans un cadre institutionnel organisé et (iii) des politiques incitatives raisonnées.

Dans des régions limitées du Maroc qui re oivent une pluviométrie bonne moyenne, une intensification incorporant cultures fourragères et différents concentrés et exploitant la complémentarité des ressources génétiques locales, seules ou en combinaison avec des races exotiques dans le cadre de croisement, serait possible.

Face cette situation on peut envisager deux stratégies complémentaires :

(i) accro tre la productivité céréalière et animale par la spécialisation des systèmes de production

(ii) améliorer l'efficacité de l'association culture-élevage par une intensification conjointe des productions animales et végétales. Plusieurs techniques pour une intensification raisonnée ont été présentées dans les différents chapitres parmi lesquelles il faudra choisir la plus adaptée au système de production en question. L'adoption de ces technologies nécessite un cadre politique et institutionnel adéquat et la formation des éleveurs et des agents de développement.

La première stratégie est motivée par une intégration spatiale au niveau du pays basée sur la vocation des terres et du savoir-faire des producteurs. La logique d'une telle intégration est multiple :

(i) la logique "éco-système" : au vu des problèmes de dégradation que connaissent les systèmes de production extensifs, une partie du schéma de production peut être effectuée dans d'autres régions avec des potentialités meilleures

(ii) la logique "filière" : intégration complémentaire des différents segments de la production (naisseur – engraisseur) aux autres maillons (transformation, distribution)

(iv) la logique "marché" : demande d'un certain type de viande / carcasse que l'on ne peut obtenir dans les systèmes de production extensifs

(v) la logique territoriale du "Plan moutonnier" qui a défini les zones de berceaux de race et les zones de croisement.

Les conditions de réussite de cette stratégie s'appuient nécessairement sur le respect des ressources naturelles associant complémentarité entre les différents systèmes de production et équité sociale, économique et environnementale.

A priori, le scénario d'une intensification poussée au détriment d'un élevage extensif sur les espaces pastoraux et sylvo-pastoraux d'une part et d'une véritable intégration culture - élevage sur l'espace agricole d'autre part se heurtera plusieurs contraintes :

(i) il accentuerait davantage les problèmes de dégradation des parcours et renforcerait davantage et la marginalisation et les disparités économiques et sociales l'encontre de ces territoires

(ii) la vocation des espaces pastoraux et sylvo pastoraux et l'adaptation des ressources génétiques ovines qui s'y trouvent seraient remises en cause par l'intensification

(iii) la contrainte climatique (faible pluviométrie) dans les zones pluviales rendrait l'intensification par la production fourragère peu compétitive face aux UF gratuites, au moins dans le court terme

(iv) la demande accrue pour les cultures vivrières militerait en faveur de l'allocation de la ressource terre prioritairement vers ces spéculations aux dépens des cultures pour le cheptel

(v) la cherté de co ts de production (par rapport aux prix du marché international) des graines de céréales (notamment l'orge) fait que l'intensification doit passer par le recours l'importation de ces denrées avec les problèmes de sortie de devise que cela demande.

uels effets des accords de libre change

La politique de développement suivie depuis les années 80 avait comme objectif l'autosuffisance alimentaire, ce qui a donné un système complexe de fixation des prix, de contingentement

l'importation, créant un dysfonctionnement des marchés. Depuis 1983, le Maroc s'est engagé dans un programme d'ajustement structurel (PAS) visant le rétablissement des grands équilibres macro-économiques. Cette politique s'est traduite par une libéralisation des prix, par le transfert au secteur privé de certaines opérations assurées par l'Etat, par la libéralisation du commerce extérieur et par la protection de la production nationale. Cependant, en ce qui concerne les viandes rouges, les mesures prises n'ont pas encore touché la libéralisation des prix, qui sont encore fixés dans de nombreux abattoirs. Par contre, le commerce extérieur a été libéralisé avec la mise en place d'un système de protection de la production nationale, conformément aux accords du GATT. Les récents accords de libre échange signés par le Maroc, et en particulier celui avec les EUA, ne seront pas sans effet sur le fonctionnement de la filière viandes rouges en général et de la viande ovine en particulier. En effet, l'ouverture de notre marché la fois des produits animaux et des intrants alimentaires pour le cheptel avec des droits de douane en diminution progressive induira certainement des réajustements dans les activités entre systèmes de production (extensif *vs* intensif) et entre les principales viandes produites (bovine, ovine, caprine et volaille).

A court terme, on pourrait penser que la détaxation des matières premières entrant dans l'alimentation animale dans le cadre du libre échange avec les USA se traduirait par une réduction importante des co ts de production des produits animaux (viandes rouges, laits, produits avicole, etc.). Par la suite, le secteur devra conna tre un profond remaniement pour faire face l'entrée des viandes blanches et rouge d'une certaine qualité. Des prévisions précises sur l'impact de ce libre échange spécifiquement sur chacun des systèmes de production ovins et sur les différentes classes d'exploitation pratiquant cet élevage peuvent s'avérer difficiles pour le moment.

En effet les autres volets concernés par cet accord, notamment celui des céréales, exerceront certainement des interférences sur les modes de production et les performances des différents élevages en particulier et sur l'utilisation des terres dans les différents agro-écosystèmes en général. S'adonner ce genre d'analyse prévisionnelle constitue un champ fertile de recherche en matière de modélisation et renseignera sur le devenir, voire la durabilité, des différentes formes de l'élevage ovin dans le Royaume.

Dans un premier temps on pourrait penser que l'élevage extensif du mouton au Maroc pourrait présenter un avantage comparatif. Cet avantage a pu être entretenu, tort, cause du concept de la gratuité des ressources alimentaires sur les parcours. Ce concept doit être sérieusement reconsidéré au vu de la dégradation qui sévit sur ces espaces. Il est même envisageable que l'importation massive d'aliments des prix intéressants pourrait fragiliser davantage les espaces pastoraux qui verraient leur vocation se transformer en une véritable "bergerie ciel ouvert".

La libéralisation des échanges qui s'impose dans le cadre des accords mondiaux (OMC) ou régionaux et que le Maroc a ratifié risque de renforcer la vulnérabilité des exploitations des zones arides par une diminution des subventions ou formes de soutien sur les prix la production, ce qui devrait se traduire par une diminution des prix des céréales voire même de ceux des ovins.

Cependant, on pourrait penser que le prix des ovins soit largement indépendant des prix extérieurs, du moins pour environ 50% de la production annuelle. En effet, la demande particulière de l'A d (animaux vivants, avec des critères locaux relatifs au cornes, aspects, état d'engraissement, etc.) ne risque pas d être confrontée une concurrence extérieure soutenue.

Pour résister cette ouverture, voire améliorer leur condition de vie, les producteurs peuvent soit chercher augmenter leur productivité, soit diversifier leurs activités, soit opter pour un système extensif peu co teux.

Dès lors les politiques d'accompagnement de la mise en place des accords de libre échange, avec leur corollaire "réduction du contr le de l'Etat, moins de subventions", doivent être raisonnés dans cet espace multi-varié, difficile et vulnérable.

Dans ce contexte d'ouverture, la recherche agronomique est interpellée plus que jamais pour accagner le secteur ovin dans les domaines de la production et de la commercialisation avec des approches multi-disciplinaires et multi-institutionnelles.

uel r le pour les institutions de recherche et de d veloppement ?

Les innovations disponibles en matière d'agriculture et d élevage (y compris l'expérience internationale dans le domaine) ne permettent pas d'assurer avec une certitude suffisante (du fait des risques climatiques) le résultat supplémentaire théoriquement attendu de l'innovation testée dans les stations de recherche ou les laboratoires. A ce titre, on assiste globalement un problème d'adaptation des connaissances accumulées l'aléa climatique.

En filigrane, et sur le plan institutionnel, on relève les retards dans l'organisation de la recherche, de la vulgarisation et de la profession dans l'accompagnement du secteur ovin.

Les recherches socio-économiques doivent analyser les problèmes que rencontrent les exploitations en zones arides dans l'adoption de nouvelles technologies et d'évaluer les politiques ou les mesures d'accompagnement susceptibles de faciliter l'accès des producteurs ces technologies, afin d'améliorer leur compétitivité dans le cadre du nouvel ordre économique (globalisation, OMC, zones de libre échange). Les effets des changements de politique comme les perspectives seront abordés du point de vue des petites et moyennes exploitations agricoles en zones arides et semi arides o domine la production de petits ruminants, exploitations fortement soumises aux risques climatiques et de marché et les plus menacées par la globalisation des échanges.

Toute recherche entreprise doit développer des approches intégrées des systèmes d'exploitation pour comprendre les blocages de l'adoption de nouvelles technologies ou le maintien de pratiques ou itinéraires traditionnels. Parallèlement, de nombreux travaux de recherche pluridisciplinaire tentent de développer des paquets technologiques, des savoirs-faire dans les différents domaines de l'élevage, de l'agriculture et de l'environnement (gestion raisonnée des ressources limitées en eau, moyens intégrés de lutte contre l'érosion) et ce en association croissante avec des institutions étatiques et non gouvernementales. Cependant, le transfert technologique n'est pas toujours au niveau souhaité et les exploitations dans les zones arides et semi-arides restent encore trop souvent en dehors du progrès technologique. Ce faible niveau d'adoption est expliqué par des facteurs institutionnels (accès limité au crédit, fragmentation foncière) mais aussi par une forte variabilité climatique, sans compter la faible disponibilité de référentiels techniques adaptés ces zones.

Le développement intégré de l'élevage ovin passe par une intégration des efforts plusieurs niveaux : (i) entre les différentes disciplines zootechniques, vétérinaires, agronomiques, économiques et des sciences sociales et (ii) entre différentes institutions (recherche, développement et organisation professionnelle).

Une approche systémique doit être suivie en accordant une attention la filière dans sa globalité, dont l'analyse des contraintes et des atouts dépasse le cadre strict des systèmes de production. A ce titre, la programmation, l exécution et l évaluation participative des actions de recherche et de développement doivent être mises en uvre.

Tout au long de cet ouvrage, les acquis et les besoins en recherche ont été énumérés dans les différents systèmes de production. Il est également nécessaire pour les instituions de recherche de disposer d'une certaine visibilité en matière d'objectif de développement du secteur de l'élevage ovin et d'un engagement de la part de l'Etat sur un financement public pluriannuel dans le cadre de contrats programmes moyen terme.

uel r le pour la formation sup rieure ?

La faible disponibilité des référentiels technico-économiques pour les différents systèmes de production rend difficile leur pilotage et l'évaluation de l'impact des différentes interventions sur leur performance et leur dynamique. De par le passé et parallèlement au discours officiel sur la multifonctionnalité en agriculture, le modèle intensif de production reste largement dominant au niveau de la formation, de la recherche et du conseil technique. Ce n'est que récemment et de manière inévitable, que les pouvoirs publics se sont orientés vers la problématique de l'agriculture (production végétale et animale) extensive. Cependant, les résultats sont très différents d'un site l'autre et aucune approche globale n'a pu être mise au point pour faire face cette problématique.

Le nouveau contexte national, régional et international nécessite une restructuration du système actuel de formation de l'ingénieur zootechnicien et du vétérinaire. Suite une réflexion menée par l'Institut Agronomique et Vétérinaire Hassan II en concertation avec plusieurs acteurs, il s'est dégagé que la formation agronomique et vétérinaire doit être réajustée pour accompagner: (i) l'évolution rapide des sciences et des technologies (ii) le changement des besoins du secteur de la production animale et la difficulté d'en cerner l'évolution et (iii) la révolution numérique associée l'évolution des nouvelles technologies de l'information et de la communication.

Selon cette réflexion, il ressort que les objectifs de la formation sont recentrer par rapport ces enjeux et par rapport la polyvalence, la spécialisation et la professionnalisation. Le nouveau cursus de formation visera prioritairement : (i) l'acquisition des connaissances de base en relation avec la capacité d'adaptation (ii) le développement des compétences nécessaires l'exercice du métier d'ingénieur agronome et (iii) la promotion du potentiel professionnel des futurs lauréats en vue de leur insertion rapide dans le marché du travail.

Il est ainsi envisagé que l'acquisition des connaissances de base et le développement des compétences permettent aux futurs ingénieurs d'avoir une culture générale solide et d'être outillés pour comprendre les interactions entre disciplines, cerner les interfaces et disposer d'une grande capacité d'adaptation aux différentes situations techniques, économiques, socioculturelles et environnementales.

uel r le pour l information et l encadrement ?

Les solutions envisagées pour promouvoir le développement de l élevage ovin ne seront évidemment efficaces que si elles peuvent être mises en application. Pour cela, il est indispensable que soit assurée une meilleure formation, l information et l encadrement des éleveurs, quel qu en soit le niveau de scolarisation.

Pour y arriver, il est notamment nécessaire que les connaissances acquises par les recherches menées dans le pays et ailleurs et les technologies qui en dérivent, puissent être transposées et adaptées valablement au niveau des exploitations agricoles. Cela signifie d abord que le pays doit assurer un certain nombre d'ingénieurs la capacité de bien ma triser les réalités du terrain en élevage ovin et de communiquer aux techniciens et éleveurs les acquis de la recherche et les technologies.

Les techniciens des organismes publics et privés responsables de l encadrement des éleveurs sont appelés jouer un r le primordial dans le développement de l élevage. Ils doivent avoir une formation adéquate et spécifique en élevage ovin pour en comprendre et ma triser aussi bien les aspects théoriques que pratiques. Ils doivent être capables de descendre efficacement sur le terrain pour aider les éleveurs mettre en place et ma triser tous les aspects de leur élevage. Ils doivent notamment être capables de mettre au point avec leurs formateurs les techniques adéquates d information des éleveurs selon leur niveau de scolarisation.

Conclusions

L élevage des moutons est une composante économique et sociale importante de l agriculture marocaine. Il présente une grande diversité et peut être divisé en grands systèmes de production.

L élevage ovin marocain dispose de nombreux atouts qui devraient en favoriser le développement, mais il est aussi soumis de multiples contraintes qui, si elles ne sont pas rencontrées, risquent de mettre son avenir en danger.

La conservation des ressources naturelles et plus particulièrement des zones de p turage constitue un défi majeur pour le pays. Si des mesures adéquates et efficaces ne sont pas rapidement mises en application, un risque de dégradation accrue du pays est évident et il mettra en péril les productions animales.

Pour que l élevage en général, celui du mouton en particulier, puisse jouer pleinement son r le de

pourvoyeur d emplois et de revenus, d assurance pour la sécurité alimentaire du pays, et de ma trise de l équilibre entre les zones urbaines et rurales, il ne para t pas nécessaire d augmenter les effectifs, mais plut t d assurer l effectif existant une nette amélioration des performances et de la productivité.

Pour que les variantes améliorées en matière d'amélioration génétique et de conduite du cheptel puissent porter leurs fruits, il est indispensable que, ensemble, décideurs politiques, chercheurs, organismes publiques et privés d encadrement et surtout éleveurs unissent leurs forces pour la mise en pratique efficace des mesures prendre. Cette mise en place passera notamment par un soutien financier adéquat au secteur, mais aussi par une amélioration de la formation et de l information des acteurs impliqués et l'organisation des producteurs.

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The sustainable production of Mediterranean cheeses. **ighlights of the home-made cheeses from Sierra de C di Andalusia Spain**

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SUMMARY – The production of goat and sheep milk cheeses in "Sierra de C diz" is an example of environmental and socioeconomic sustainable production, besides a relevant element of diversity, and rural development. The origin of the milk coming from autochthonous breeds the extensive feeding system (Natural Parks of Grazalema and Alcornocales) and homemade production justify this assumption. In this paper, sustainable cheese production is explained, based on two surveys conducted among stockbreeders and cheese makers, besides interviews with local experts.

Keywords: Sustainable production, goat and sheep milk, autochthonous breeds, homemade milk cheese, Sierra de C diz.

R SUM – *"La production durable de fromages méditerranéennes. ighlights de fromages artisanals de Sierra de C di , Andalusia (Espagne)" La production de fromages de chèvre et de brebis de la Sierra de C di est un exemple de durabilité, un élément de diversification économique et, en définitive, un modèle de développement durable. L'origine du lait, provenant des races autochtones, l influence de l'alimentation dans l'écosystème extensif (Parcs Régionaux de Gra alema et Los Alcornocales), ainsi que le mode artisanal de production des fromages sont les facteurs principaux de la durabilité. Dans cette communication on fait une description de l'influence des paramètres de la production laitière et de l'élaboration fromagère dans la diversification et le développement durable de ce milieu naturel, paramètres obtenus d'après la réalisation d enqu tes auprès des éleveurs, fromagers et experts sur l écosystème de travail. Les principales conclusions sont egalement exposées.*

Mo s s : *Durabilité, troupeau de caprins et brebis laitières, races autochtones, fromage artisanal, Sierra de C di (Montagne).*

Introduction

Sustainability can be translated in terms of agricultural production as: "sustenance of current population without endangering the biologic capability of nature to assure forthcoming generations sustenance, and carrying out without making unfair disparities between the two social groups" (Baigorri, 2001).

Extensive goat and sheep livestock has been always important sectors in mountain areas from the social, economic, and environmental points of view: (i) well adapted to the land (ii) keeping the ecosystem of pasturages and meadows ("dehesa" in Spanish language) (iii) protecting the area against fire, and erosion and (iv) finally, maintaining population to rural areas. The Mediterranean basin shows besides a high technical-economic development level, cultural aspects based on traditions, and quality agrofood productions. In this framework, because the new Common Agricultural Policy (moving towards a more sustainable policy), and the increasing consumer's perception of quality sustainable productions, actions in the way to increase added value of these outputs have to be undertaken.

Short description of the production area

The south-western part of "Sierra de C diz" (Fig. 1) is the area where extensive livestock of goats

and sheep make their living. It is an ecosystem of great value environmentally speaking (included in Natural Park of Grazalema). Meadows of ilex and cork trees ("dehesa"), jointly with pine trees and pasturage represent their main flora. The autochthonous breeds: "Payoya" (goat) and "Merina de Grazalema" (sheep) are the most representative ones here.

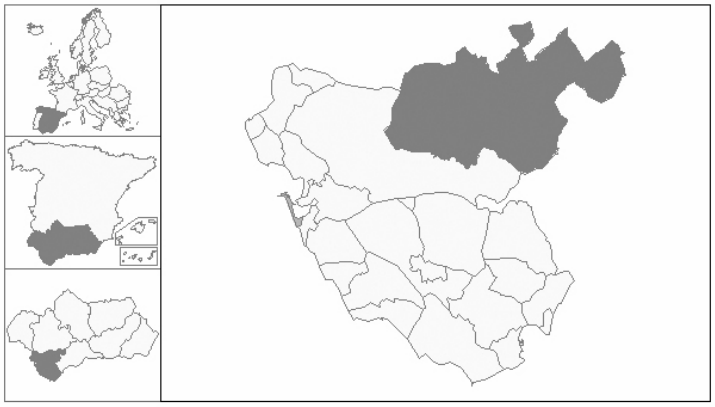

Fig. 1. Map of "Sierra de C diz".

Caprine is the first stockbreeding sector regarding milk production. It accounts for 44,655 goats in 325 farms (Diputación de C diz, 2001). Olvera, Algodonales, Grazalema, and Zahara de la Sierra are the major producing councils. The flocks of goats decreased over the last few years (around 30%), increasing significantly the number of heads/farm on the other hand (Mena *et al.,* 2005). Farms are based on a vast surface with an average of 140 goats/farm, but this number is quite variable (there are farms with less than 50 units and some others with more than 1,000 animals).

"Payoya" is an autochthonous goat breed showing tall and large individuals with a polychrome coat, and well adapted to the area, not having any competition here with any other stockbreeding species. It is at risk of becoming extinct, having the Association of "Payoya" breeders to defend their continuity and to improve their genetic.

The dairy ovine sector is shorter than the caprine one. It accounts for 5,000 heads in 30 farms. The evolution of the ovine livestock went down sharply (there were around 15,000 milking heads in Olvera in the past sixties). "Merina de Grazalema", a white and blonde sheep whit fine fleece, is the most representative breed in Sierra de C diz, being the only autochthonous dairy sheep in Andalusia. Since it is also under the risk of extinction, the Association of "Merino de Grazalema" Breeders (34 members and 4,500 animals) works to preserve it.

The extensive system consist in feeding animals with natural pasturage from fall to summer and then with stubble coming from cereals and other cultivated crops (goats and ewes are supplemented during lactation in the milking time). Goat kidding is concentrated in fall to make the best use of pasturage and to take advantage of the best price paid for kids at Christmas time in the case of ewe, lambing is concentrated at the end of winter to take advantage of spring natural pasturage. Most of the milk is sold to big dairy companies, despite an important part of it is devoted to local cheese factories. Some stockbreeders make organic production because it is a very close system to the traditional one.

The production of cheeses

There are nine cheese dairies in "Sierra de C diz", eight of them can be considered as farmhouse cheese dairies. Despite they are distributed all along the area, it is close to "Natural Park of Grazalema" where they are mostly concentrated. Most of the firms are owned and managed by families, some others are cooperatives and the remaining ones have other association formulae. On spite of most of them has a very recent origin, the smallest firms belong to experienced cheese

makers who invested in facilities to fulfil the current public health regulations. They employ a total of 56 people with a high rate of women (5 cheese diaries are run by women).

The total volume of milk used is 3.8 millions litres/year, 3 millions litres/year is goat milk (78.1%), 700,000 litres/year cow milk (18.5%), and more than 3% (118,845 litres/year) sheep milk. The biggest cheese diary belongs to "Fromandal S.A.". This firm and the cooperatives "Apiolvera", and "El Bosqueño" make mainly cow or mix (cow and goat) fresh cheeses. The remaining ones can be considered as small farmhouse cheese diaries. It is significant to say that some cheese dairies produce organic cheeses of sheep ("La Oliva") and goat ("La Cabra Verde"). The typology of the cheeses produced in the zone is very large including: fresh cheese of goat, semi-cured and cured cheeses of goat and goat-cow and curd cheese. All cured cheeses are offered according to the following specialities: with olive oil, olive oil and cayenne pepper, lard of Iberian pork, and wheat bran.

Milk comes from local or regional stockbreeders (from the county of C diz or from the adjacent ones M laga and Sevilla), 141 of them are goatherds, 27 shepherds, and 6 cattle tenders. There are two producing farmstead cheeses ("L cteos Marant" and "Oliva"). Sales are mainly carried out in short radio (local or regional) markets. Only "El Payoyo" has a wider operational range (regional or national). It is very significant to notice that all the cheese dairies have a sale shop.

Parameters related with quality have been valued by the cheese makers, as well as the influence of quality in their profits (Figs 2 and 3). The most remarkable results are: (i) personnel s hygiene and facilities cleanliness affect directly to quality (ii) milk quality is other important direct parameter and (iii) the influence of the environment has been also shown, pointing out the importance that the autochthonous breeds, and the extensive feeding system have in the quality of cheeses. Handmade production, despite having been well valued in general, has a lower score in the answers of the biggest cheese dairies, mainly devoted to the production of fresh cheeses, with an important component of cow milk. These firms gave higher importance to mechanization on the other hand.

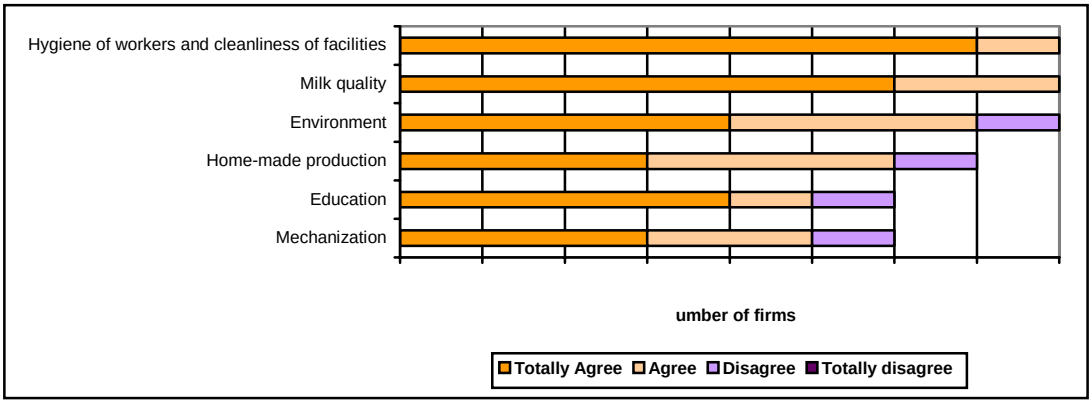

Fig. 2. Evaluation of the parameters affecting to quality handmade cheeses of "Sierra de C diz".

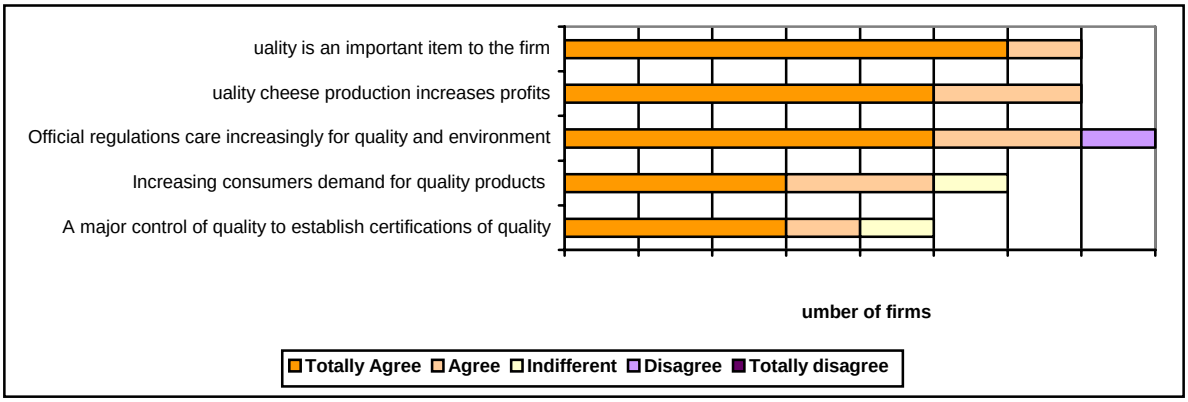

Fig. 3. Economic and administrative aspects of quality.

Regarding the economic and administrative effects of the production of quality cheeses, there is a high consensus on the importance of quality, and its relationship to the economic results, because it becomes in a major demand on the part of consumers. Nevertheless, they underline that current legislation is tending to be more and more strict (what can be translated as an extra difficulty to be part of the role of public certifications).

The Sector is asking for two Protected Designation of Origin (PDO): " ueso de la Sierra de Cadiz" and " ueso de Grazalema". The first one is devoted to the cheeses elaborated with milk of the goat breed "Payoya" and the second one to the cheeses made with milk of the sheep breed "Merino of Grazalema". In both cases factors like the defence of autochthonous races, the extensive system of feeding, and the traditional know-how in the production are underlined.

Table 1 describes milk and cheese parameters affecting sustainability[1], stressing the following ones: (i) the environmental consequences of the extensive use of natural resources (ii) the social and cultural impacts derived from activities linked to territory, and their patrimonial values (history, tradition, craft, "know-how, culture) (iii) from the economic point of view, for being activities performed by small-medium size firms, employing to many people, with a high rate of women, and being products highly demanded by select consumers and (iv) the institutional aspects of leadership and rural development. The multifunctional effect due to their relationship with other local agro-food products (olive oil, sausages, gastronomy in general), and economic sectors linked to services (tourism, catering, etc.) are also important items to consider in addition.

Table 1. Elements of sustainability of the stockbreeding and homemade cheeses of "Sierra de C diz"

Environmental	
	roduction of milk
	Use of natural resources and maintenance of the ecosystem dynamic.
	Increase organic farming
	Maintenance autochthonous breeds: "Payoya" goat "Merina de Grazalema" sheep
	Fire and environment protection
	roduction of cheese
	The environmental impacts of cheese dairies depend upon public health regulations, and because the consequences of a higher demand of better quality milk by cheese makers
	Milk coming from autochthonous breeds is better valued: indirect support to these breeds
	Valuation of the quality of the milk coming from animals following an extensive feeding system, and from those carrying out organic cattle raising
Sociocultural	
	roduction of milk
	To keep population in rural areas
	Important activity in the area: 325 farms of goats and more than 30 farms of sheep
	Associations of breeders: "Cabra Payoya" and "Merino de Grazalema"
	Value added for rural areas patrimony (environment, history, landscape, etc.)
	roduction of cheese
	Employment (56 direct workers, high rate of women employment)
	A choice to globalization
	An instrument to learn about culture and traditions
	A factor for increasing rural development
	A way to exchange experiences regarding production and marketing
Economic	
	roduction of milk
	Source of income for many people
	Rising milk prices as a result of quality
	Existing stockbreeder's cooperatives based on the production of livestock inputs and machinery
	roduction of cheese
	A basic element of agricultural "multifunctionality" linked to rural tourism and local gastronomy
	An increase of cheese maker's income due the higher demand of these quality cheeses
	An increase of sells in short radio channels: local markets, restoration, "gourmet" shops, etc.
Institutional	
	roduction of milk
	Leadership and social organization in favour of territory.
	Initiatives for local development.
	Participation in groups of rural development
	roduction of cheese
	As a consequence of the coming PDO and the mark "Sierra de C diz y P.N. de los Alcornocales"

[1]This information comes from Navarro *et al*. (2005), Diputación de C diz (2001), and a large amount of secondary information not mentioned in the bibliography, and the overall knowledge the authors have on the stockbreeding sector.

Conclusions

The productive natural handicaps of mountain areas, the low educational level of local farmers, and few marketing channels for handmade productions, need imaginative formulae to get added value according to quality. The keys to success for these less developed areas and quality productions are not the same as the ones followed in more productive agricultural areas and sectors. They must be linked to natural values, and local traditions on the other hand. But to reach success it is necessary to have great implication of actors in the processes of management and marketing. It is necessary to work on: (i) the characteristics and values of the product itself, and its relationship with the environment (ii) generating marketing associations (iii) the establishment of common bonds with culture and local patrimony (iv) searching synergies with rural tourism (v) increasing sales in short-radio marketing channels: farm, specific markets or specialized shops and (vi) likewise, the public support regarding technical advice, promotion, researching and development.

We want to finish this presentation with some basic actions to improve sustainable development of quality product in rural areas: (i) participation in Spanish and European organizations involved in the defence of quality products in rural areas (ii) requesting institutional support for both, financial and technical activities, regarding research, innovation, and education (iii) to be involved in scientific, technical, and cooperation projects, to exchange information between producers and/or technicians and (iv) encourage association and cooperation actions.

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The last survivors of Grey cattle resisting extinction. A case study of characteristics and sustainability of traditional systems of native Grey cattle breeds

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SUMMARY – It is concluded that pure breed Grey cattle as a source of farm animal genetic resources remain only in marginal areas of the Enez and Ipsala districts of the Thrace region (Turkey) which previously had a large population. A survey aimed to provide a general panorama of Grey cattle husbandry was applied in 6 localities of the region such as the villages of Chandir, Isiklar, Hisarli, Karpuzlu and the suburbs of Enez and Ipsala. Fifteen cattle breeders were interviewed for the survey. According to the source of the pre-herd book project of the Ministry of Agriculture, the three provinces of Edirne (97%), Kirklareli (0.26%) Tekirdag (1.9%) of the Thrace region have a total Grey cattle population of 5301 head. The Enez and Ipsala district of the Edirne province have the share of 67.8% and 26.9% of the population respectively. Education levels of the cattle breeders were high school (4%), middle school (20%) and elementary school (76%). All Grey cattle breeders practised only cattle husbandry as a source of income. The herd composition was 75% female and 25% male. The average herd size was 57.88 heads. The average number of family members was 4.76. The average age of cattle breeders was 46.2. Due to adaptive advantages of Grey cattle genotypes to the poor pasture and wetland area of the regions even very particular primitive or unproductive systems are practised. Grey cattle production systems in this area have potential from the sustainability point of view. Grey cattle fattening experiences showed that at an average weight of 155 kg, two-year old males can gain 58.53 kg after three months of fattening.

Keywords: Boz Steppe cattle, Turkish Grey Cattle, animal genetic resources.

RÉSUMÉ – "Les derniers bovins gris survivant à l'extinction. Etude de cas sur les caractéristiques et la durabilité du système traditionnel de la race autochtone de bovins gris". Il est conclu que la race pure de bovins gris, en tant que vivier de ressources génétiques animales comme animaux d'élevage, ne subsistait que dans des zones marginales des districts d'Enez et d'Ipsala dans la région de Thrace, où existait auparavant une vaste population. Une étude visant à examiner la situation générale de l'élevage de bovins gris a été menée dans six localités de la région telles que les villages de Chandir, Isiklar, Hisarli, Karpuzlu et les zones environnantes d'Enez et d'Ipsala. Une quinzaine d'éleveurs ont fait l'objet d'enquêtes pour cette étude. Selon le livre généalogique préliminaire, qui est un projet du Ministère de l'Agriculture, les trois provinces d'Edirne (97%), Kirklareli (0,26%) et Tekirdag (1,9%) de la région de Thrace présentent une population totale de bovins gris de 5301 têtes. Les districts d'Enez et d'Ipsala de la province d'Edirne représentent respectivement une part de 67,8% et 26,9% de la population. Les niveaux d'instruction des éleveurs correspondent aux études secondaires (4%), études intermédiaires (20%) et études primaires (76%). Tous les éleveurs de bovins gris ne pratiquaient que l'élevage bovin comme source de revenu. La composition des troupeaux était de 75% de femelles et 25% de mâles. La taille moyenne du troupeau était de 57,88 têtes. La famille comptait un nombre moyen de 4,76 membres. L'âge moyen des éleveurs bovins était de 46,2 ans. En raison des avantages adaptatifs des génotypes de bovins gris sur pâturages pauvres et zones humides de ces régions, il existait même des systèmes particulièrement primitifs ou improductifs. Les systèmes de production de bovins gris dans cette zone ont un bon potentiel du point de vue de la durabilité. Les expériences d'engraissement de bovins gris montrent qu'à un poids moyen de 155 kg, les mâles de deux ans peuvent gagner 58,53 kg en trois mois d'engraissement.

Mots-clés : Bovins de la steppe type Boz, bovins gris de Turquie, ressources génétiques animales.

Introduction

During the last few decades modern breeding techniques have greatly improved the production potential of farm animal species. Due to pressure of crossbreeding, the number of native breeds are rapidly decreasing. These trends have led to the use of intensive crossbreeding of native breeds with exotic imported western breeds. In conclusion, while the percentage of modern breeds has increased, the percentage of native farm animal breeds has come into the danger zone of extinction. This trend

of loss of variation also narrows the genetic base of species in general. As a consequence of the development in animal husbandry on better land and climatic areas, indigenous breeds have either been completely replaced by high yielding animals or replaced by large upgraded western breeds that respond better to improved feeding and management and intensive production conditions.

As a case study, this text will present one of the cattle breeds called Grey cattle (or Boz Steppe cattle), believed to be the ancestor or relative of the same European Grey cattle living in Italy, Bulgaria and Hungary, which is in danger of extinction. The Grey Steppe originated in the steppe of the Ukraine from where it moved west and south into Italy, Hungary, the Balkans and Turkey in ancient times. There it formed many local breeds such as the Podolian cattle, Dalmatian Grey (which is improved by the Tyrol Grey), the former Yugoslavian Istrian from Croatia (improved by Romognola). Another grey cattle in the Balkans in the same group is named Sykia and it is a smaller variety of the Grey Steppe type. Hungarian steppe grey is crossed with Maremmana and Yugoslavian Podolian. Maremmana is crossed with Chianna and Chaoralley. Romagnola is improved with Chianna, Reggianna and Maremmana, etc. Iskar Grey (Bulgaria), Istrian (Croatia), Dalmatian Grey (Croatia), Slovenian podolian (Croatia), Katerin (Greece), Sykia (Greece), Hungarian Grey (Hungary), Cinisara (Italy), MareManna (Italy), Podolicia (Italy), Romanian steppe (Romania), Turkish Grey, Boz Steppe or Plevne (Turkey), Ukrainian Grey (Ukraine), Istrian (Yugoslavia) are a groups of similar breeds according to the EAAP-AGDB resources.

This breed was in danger of extinction due to the mechanization of agriculture and the spread of upgraded breeds which had almost completely replaced it. Turkish Grey cattle were widely distributed in the Marmara region of Turkey, the Grey cattle having emerged as an important breed as it dominated stocks in the Balkan and Marmara regions of Turkey during the Ottoman period and at the beginning of the republican period in the location mentioned. Its dramatic decline brought this breed to the point of extinction.

The remaining 500 head of the Grey Steppe cattle breed were recently put under a conservation programme by the Government. There were a few animal breeders who still continued to use these animals as breeding stock in the same village of the Keşan district in the Edirne province, located in the Thrace (European) part of Turkey. The present breeding conditions were analysed and will be presented.

According to the data of the pre-herd book of the Ministry of Agriculture, the number of Grey cattle all over Turkey was 30,643. This figure far from reflects the real conditions since no census was kept by the specialists and, especially in the case of native animal genetic resources, there was misjudgement about the origin of the breed. Besides, this figure includes both the pure breed Grey cattle and the cross breeds. Most probably this figure only considers the grey coloured cattle which include Grey cattle of our interest. Some cross breeds of cattle whose grey colour (named Kultak) can be obtained from (native black*native grey cattle) crosses.

The biggest disadvantages for this breed before was that it was not able to obtain any support measures from Government funds. Any encouragement measures of support policies excluded these breeds due to their low body weight (lower than 200 kg), since the policy aimed at increasing meat production by producing heavy carcasses targeting over 200 kg of body weight.

This kind of policy forced them to cross their native breeds with heavier exotic breeds. Table 1 shows the population structure of Grey cattle in the İpsala and Enez region.

Recently a conservation scheme was introduced and a production system for this rare but genetically valuable breed was discussed. After a public awareness campaign aiming to boost the concept of animal genetic resource conservation, the Government decided to pay an extra 150 per year/per animal for a total of 200 head of Grey cattle in the area within the framework of *in situ* conservation projects. Of the fifteen breeders who donated the data, three were selected for the programme.

First of all we would like to introduce the area where the Boz Steppe bovine population lives. The Ipsala and Enez district in the Edirne province is located in the Thrace part of Turkey at an altitude between 10 and 200 meters above sea level next to the Greek border, of the South easternmost part of the EU. Lake Gala, Lake Pamuklu G l and the Hisar mountain, now classified as a natural region, covers an area of about 6090 hectares.

Table 1. Number of pure breed Grey cattle cross breed Grey cattle raised in the Thrace region of Turkey

Provinces (% of total Grey cattle population)	District (% of total Grey cattle population)	Number of Grey cattle (head, %)	Village name	Head
Edirne (% 97.8) (5187 heads)	Enez (% 67.8)	2609 Female(72.5%) 988 Male (27.5%) 3597 Total (100%)	Hisarli	1566
			işikli	801
			andir	419
			Merkez	383
			ataltepe	349
			Karaincirli	27
			Yenice	22
	İpsala (%26.9)	1170 Female (82.1%) 255 Male (17.9%) 1425 Total (100%)	Yeni Karpuzlu	1048
			Merkez	165
			Saricaali	99
			Kumdere	40
			Paşak y	36
	Keşan (%2.99)	97 Female (61%) 62 Male (39%) 159 Total (100%)	Kizkapan	17
			Maltepe	48
			Sazlidere	15
			Yayla	51
	Havsa	2		
	Lalapaşa	2		
	Uzunk pr	2		
Tekirdağ (%1.9) (100 head)	Malkara	76 head= 48 Female,28 Male	Karacahalil	46
	Şark y	18 Female	Mursalli	11
	orlu	1 Male		
	Kof az	2 Female		
	L leburgaz	1 Male		
	Pinarhisar	1 Female		
	Vize	1 Female		
	Saray	5 head= 4 Female,1 Male		
Kirklareli (0.26%) (14 head)	Demirk y	9 head= 8 Female,1 Male		

Species	Cattle (*Bos taurus*).
Breed	Boz Irk.
International names	Anatolian Grey, Turkish Grey.
Local names	Boz, Step Siğiri, Plevne Siğiri.
Area of distribution	Trakya, South Marmara, North Aegea. West of Central Anatolia
Production purpose	Meat, milk

Ipsala and Enez are far from the industrial centre, thus guaranteeing unpolluted air and a clean environment. There are a lot of natural pastures and woods which represent the most important sources of animal nutrition. This area is well known for rice cultivation, so plenty of rice stalks are available for animal nutrition free of charge. Nowadays the trends show that the Turkish countryside is often characterized by the exclusion and neglection of the outlying territories which also suffer

progressive depopulation, especially of young people. The Grey cattle is sturdy, of medium size silver-grey in colour and with crescent-shaped horns

Material and methods

A total of 15 breeders provided data for the survey. A questionnaire regarding activities, land structure, animal nutrition and productive traits was used for all (15) breeders who represented the Grey cattle breeders region, and data from the pre-herd book from the Ministry of Agriculture were also used.

The only relatively medium scale farmers (who had at least 15 head of Grey cattle), family enterprises, were included in our survey material. Those who only had 1-2 head of Grey cattle were not included in this survey.

The aim of this work was to evaluate the present production characteristics of Grey cattle from the point of view of animal genetic resource conservation. The breeding techniques, productivity parameters and visual morphological characteristics were presented.

The survey area mainly consisted of the Candir village on the Hisarli mountain of the Enez district and nearby villages such as Karpuzlu and Çandir. This village is located near Mount Hisar alongside the Maritsa river which follows the Greece-Turkey border.

Results and discussion

Physical characteristics and genetic resources

This breed has alternatively been called Boz Irk (grey breed) or Boz Steppe (Grey Steppe). While light coats are not liked by new breeders, animal coats occur in all shades of grey. The muzzle, eyelashes and claws are black. Calves are born reddish and turn grey at six months of age. The skin colour is generally dark grey. The horns have a characteristic crescent shape. The inside of the ears is covered by black hair. In the adults the horn tips are black and their lower portion is yellowish white. Cows generally have a lighter colour than males. Generally sexual dimorphism is pronounced in both size and body proportions. Bulls have stronger forequarters, larger dewlaps and are more robust than cows. Grey cattle mature late and deposit relatively little yellow fat under the skin. Only sporadic data are available on fattening characteristics. Visual inspection shows that the meat itself is dark and not particularly marbled since most suet forms subcutaneous and intestinal fat deposits (Table 2).

Although there are no big differences in the colour by visual observation of the breed; the Grey cattle group can be separated according to farmers' explanations.

In general the Grey cattle population in the Thrace region is 5301 head (Table 1), according to the pre herdbook data from the Ministry of Agriculture. These figures were obtained from the National Register projects for ear-tagging the cattle. The figures include cross breeds derived from Grey cattle.

No system to resurrect pedigrees has been put into practice. The Edirne province has the biggest share of the Trakya Bozstep (Grey Cattle) population with 97% (5187 heads). The other two provinces only have 114 head which represent 3% of the Thrace population. The Boz Steppe population in Thrace consisted of 75% female and 25% male.

It is argued that especially small-scale breeders have been forced to cross their pure breed Grey cattle by Brown Swiss or black and white (Holstein) cattle for productivity reasons.

Fortunately it seems that the regulation regarding in situ conservation and support programmes for animal genetic resources acted by the governmental decisions 25737/2005 had managed to stop this inconvenient decline in time.

A total of three farmers, each having 50 head of Boz Steppe cattle, were selected from the Çandir village of the Enez district of the Edirne province, to receive 150 euro per year per animal in the

framework of an in situ conservation programme. These herds were the most protected pure Grey cattle populations. The remaining population was under threat of genetic erosion by means of crossbreeding (F1) or (Gn) level.

Table 2. Morphological traits of Grey Steppe cattle

Description of body conformation		Robust structure. The rump structure in the tail head is extremely narrow, hence the triangular view from above. The back of the body is narrower than the front especially in males. The rump is higher than the withers						
Colour	Colour of skin	Dark grey						
	Colour of hair	Varied from light silver to dark ash in colour. Black colour around the eyes in bulls, black coloured upper limit of muzzle of bulls. Inside of ear covered with black hair. Cows are lighter in colour than bulls. Generally neck breast, chest lower part of shoulder are darker in colour						
	Colour of claw	Black						
	Colour of horn	Bottoms are yellowish white, black tips						
	Colour of calf	Born light brown then gradually turn grey						
Head characteristics	Structure of head	Head narrow and long, square shaped forehead, face has rectangular shape						
	Structure of horn	Circled cross-section, non nodulated						
	Head measurements (cm)		Male			Female		
			Min.	Max.	mean	Min.	Max.	Mean
		Length				35.0	56.0	45.38
		Width				18.0	27.0	20.23
	Horn measurements (cm)	Length				8.0	46.0	28.61
		Circumference				10.0	24.0	15.35
		Distance between the roots				11.00	21.0	12.43
	Ear	Structure	Elipsoid, large ear.					
		Length (cm)				15.0	22.0	18.95
		Width (cm)				9.5	17.0	13.99
	Colour of eye	Black.						
Adult body measurements	Wither height (cm)		122.0	130.0	126.0	103.0	136.0	117.98
	Rump height (cm)		126.0	133.5	130.10	104.0	186.0	126.22
	Body length (cm)		113.0	134.0	123.0	111.0	165.0	137.94
	Chest girth (cm)		182.0	191.0	186.80	112.0	195.0	165.89
	Chest height (cm)		66.0	73.0	68.80	53.0	72.0	62.66
	Shin girth front (cm)					13.0	28.0	17.01

Systems of production

Generally the Boz Steppe population of Thrace is reared in two different production systems, according to the number of animals per farm.

Small-scale family enterprises

In this type of Grey cattle raising system, some of the village inhabitants have 1-2 head each. This type of production is heavily dependent on pasture. Late spring, summer, autumn, winter and early

spring flocks are kept in the barn with a limited amount of supplementary concentrates without moving to the pasture due to the snow and rainy conditions.

Generally calving occurs in late winter or mostly at the beginning of spring. In fact this kind of small flock shows that they are managed as a traditional extensive cattle production system and also the primary income of farmers is not obtained from cattle husbandry.

Each day early in the morning all flocks of the farmers in the same village are unified and moved under the management of one herdman in order to utilize the common pasture in the village. In the evening all the herds return back from the common pastures of the village and animals are distributed to their owners. This kind of Grey cattle are milked before and after pasture. Additional supplementary feeding is also practised.

Milk production is comparatively lower than in the other exotic breeds.

The pastures consist of common lands and rice stubble areas. Milk production is generally for families own consumption and amounts to around 1-1.5 ton/ha

Medium- and large-scale Grey cattle population

This kind of farmer aims only at meat production. The animals are kept on pasture continuously, including winter. They never return to the village even during the cold winter season. Very simple barns of fences are located at the edge of the pastures or near the village, and are built with marshy grass and reed. In some cases cattle were housed in this kind of barn during the winter period and fed a small amount of feed supplement consisting of straw and stalks.

Cattle shows seasonal oestrus signs in May and June. Generally then calving occurs in March and April. Calves are kept together with cows during a 7-8 month period. No milking is practised 4-5 months prior to calving calves are separated from their mothers. No navel disinfection is practised

Age at puberty is regarded as 2-2.5 years. In general steers are kept together with the herd at pasture. But one of them is chosen as bull at the age of 3 years. Free martinism occurs when different villages use the same public pasture leading to some genetic mixing.

Generally cows are grazed on one common pasture or rice stubble area. Male grey cattle are generally sold at 2-2.5 years of age for meat production. Females are used for replacement. Older females over 10 years are also sold for meat production.

Big herds are kept 365 days in pasture in very inconvenient snowy conditions. Rice stalk and straw are given as supplementary feed. Rice stalk can easily be found free of charge due to the considerable amount of rice plantations in the region. Rock salt was also given as the only source of minerals.

No extra workers are employed. All manpower is provided by family members. The average age for the breeders is 48.25 (SE=9.04) in Enez and 42.56 (SE=8.53) in the İpsala region. The average number of family members in Enez and Ipsala is 4.31x1.5 and 5.56x2.19 respectively. The average number of family members for both is 4.76.

In some cases so as to meet the demand for sacrificial animals some farmers with big herds fatten cattle once a year. Generally animals over 2 years old are used for such fattening application. Fattening barns are generally semi open or fenced simple primitive places. These barns are generally located near the owners' houses in the village or on the edge of the pasture and used if needed in very cold snowy winters as temporarily protective places for the animals at pasture. These places are also used as fattening barns once a year.

The survey showed that the average space was 433.3 m^2 (SS=57.5) and consisted of 166.7m^2 (SS=76.4) for the covered part and 516.7 m^2 (SS=28.9 m^2) of open field.

Generally fattening is practised in an average group size of 15 (SE=5).The fattening animals were

brought from the farmers' own herd raised freely in pasture. At the starting period, average weight was 127 (SE= 22.17).The finishing average weight was found as 150 (SE= 24) kg. The difference or cumulative weight for the 2-3 month period was 58.35 kg (SE=17.22). 67% of farmers practised a medication programme for external parasites. Concentrated supplement feeding and dry grass are given for fattening. Most farmers are ignorant of roughage feeding such as silage and hay and of their impact on the general performance of animals.

Tables 2 to 7 show different traits of the Grey Steppe cattle.

Table 3. Reproduction traits of the Grey Steppe cattle breed

	Min.	Max.	mean
Age at first calving, month			30-36
Calving ease	Usually easy, no need for help.		
Calving interval, month			
Birth ratio, %		100.0	86.54
Survival rate (up to 6 month), %		100.0	99.0

Table 4. Milk production traits of the Grey Steppe cattle breed

Lactation length day	78.0	350.0	220.13
Lactation yield, kg	157.0	2965.0	1095.63
Milk fat, %	2.5	6.12	3.93

Table 5. Growth traits of the Grey Steppe cattle breed

	Male			Female		
	Min.	Max.	mean	Min.	Max.	mean
Birth weight (kg)	13.0	37.0	24.04	13.0	29.0	22.37
Live weight at 6 months (kg)	112.0	196.0	158.32	81.0	145.0	117.0
Live weight at 12 months (kg)	160.0	370.0	291.99	140.0	190.0	167.0
Live weight at 24 months (kg)	224.0	410.0	307.0	210.0	290.0	252.0
Adult live weight (kg)	449.0	490.0	470.0	247.0	550.0	375.07
Average daily gain (g)			1062			
Carcass yield (%)			57.39			

Table 6. Behavioural characteristics of the Grey Steppe cattle breed

Handling management ease as flock	Very well
Maternal insight	Very well
Grazing ability	Very well
Ability to be milked	Very difficult to milk. No milk let down without presence of calves.

Table 6. (cont.) Behavioural characteristics of the Grey Steppe cattle breed

Temperament	Managing is very difficult due to ill tempered and irritable nature. Only an experienced person can manage the herd.
Other	Very ill tempered and nervous temperament make handling difficult. Interaction between the herd members is very powerful. Any interference to the herd leads to the formation of a circle.
Unique capacity of breed (resistance to disease, environmental conditions)	Resistance to rapid food change. Very well developed digestive tract. Very good feed conversion ratio. Utilizing very poor diet consisted mainly of straw. High tolerance for extremely harsh environmental climatic conditions. Very resistant to disease and external parasites, very fast recovery if infected. Hard and robust claw. High acclimatization capability. Natural capacity in raising in wild and semi wild conditions
Special requirements for raising habitat	Natural habitats are forests. wetlands, rough ground, marshy places

Table 7. Genetic traits of the Grey Steppe cattle breed

Typical gene markers

Major Genes

Other	System/loci	Allele	Frequencies, %		
			Min.	Max.	mean
	F-V	F			0.66
	F-V	V			0.34
	J	J			0.31
	J	İ			0.69
	L	L			0.27
	L	I			0.73
	M	M			0.00
	M	m			1.00
	Z	Z			0.56
	Z	z			0.44
	R'-S	R'			0.21
	R'-S	S'			0.79
	Hb	A			0.95
	Hb	B			0.04
	Hb	C			0.01
	Pa	A			0.32
	Pa	B			0.68
	Am-I	B			0.79
	Am-I	C			0.21
	Tf	A	0.21	0.43	
	Tf	B	0.02	0.05	
	Tf	D			0.27
	Tf	D1			0.32
	Tf	D2			0.27
	Tf	E			0.09
	Tf	F			0.06

Other traits

Conclusions

In conclusion we can affirm that native Grey cattle represent the most interesting cattle breed in Turkey. It has moved from post endangered status and now seems to be making a comeback.

However assistance and cooperation are still required to maintain the Grey cattle special population. We confirm our interest in the development of this native cattle breed especially recording the careful utilization of the resistance to the external parasites and ability to utilize the wetland pasture alongside the Maritza river and Lake Gala in the name of proficient and sustainable utilisation of marginal territories.

According to the questionnaire's results the reasons for farmers still continuing to raise the Grey cattle populations in spite of numerous negative factors were:

(i) The production system they practised was the only system they knew and had learnt from their parents.
(ii) Relatively economical housing with almost zero cost.
(iii) No supplementation feeding cost in summer and only in very cold winters a little supplement such as rice straw, also stalk is given.
(iv) Almost 365 days keeping range and pasture consisting of evergreen oaks.
(v) As no milking is practised, low cost for raising the Grey cattle.
(vi) Comparative advantages of high level adaptability to the rocky and wetland area of the region.

The results confirm our findings that almost all the farmers practise semi-wild raising systems.

The original traditional breeding purpose of Grey cattle in Turkey was meat, and draught power. Nowadays the main breeding purpose was meat production.

Biodiversity studies of ruminant Mediterranean species through DNA molecular markers

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SUMMARY – During the last century the ruminant census has suffered an important decrease and breeds in danger of extinction have increased dramatically. The efforts to preserve these breeds have been essential to maintain their biological and ecological potential. The aim of the present work was to carry out biodiversity studies in some Mediterranean cattle, sheep, and goat breeds, through DNA molecular markers such as microsatellites. In this sense, a DNA data bank has been created for each specie. Moreover, several breeds have been genetically characterised and their differentiation and evolutive relationship have been analysed.

Keywords: Ruminant, breed, microsatellite, diversity.

R SUM – *Etudes sur la biodiversité des espèces de ruminants méditerranéens à l'aide de marqueurs moléculaires d'ADN . Durant le siècle dernier, le cheptel de ruminants a subi une baisse importante et les races menacées d'extinction ont augmenté de fa on spectaculaire. Les efforts visant à conserver ces races ont été cruciaux pour sauvegarder leur potentiel biologique et écologique. La finalité de la présente étude a été d'examiner la biodiversité che certaines races bovines, ovines et caprines méditerranéennes, à l'aide de marqueurs moléculaires d'ADN tels que les microsatellites. Dans ce sens, une banque de données ADN a été créée pour chaque espèce. En outre, plusieurs races ont été caractérisées génétiquement et leur différentiation et relation évolutive a été analysée.*

Mo s s : *ruminant, race, microsatellite, diversité*

Introduction

In recent decades there has been a decrease in population and a marked regression of livestock in the tertiary sector in rural areas. The ruminant census has suffered an important decrease and farm owners are generally the oldest members of the population since young people tend to migrate (Avellanet *et al*., 2005). The FAO alerted that about one third of the world's recognised 5000 livestock and poultry breeds were endangered (FAO, 1999; FAO/UNEP, 1995).

The change from an agricultural landscape to bushy areas of land due to the abandonment of pastures is the immediate consequence of the decrease in the ruminant census and, moreover, the loss of their function as efficient transformers of marginal Mediterranean and Para-Mediterranean vegetation in high quality animal proteins (Zervas *et al.,* 1995). These livestock populations represent a unique resource to respond to the present and future needs of breeding improvement both in developed and developing countries.

Molecular markers, like autosomal microsatellite loci, are being commonly used for the successful implementation and monitoring of *ex situ* conservation programs. In addition, their analysis is applied to the estimation of population diversity, genetic distances, genetic relationships and population genetic admixture measures.

In the present work, we analyse eleven Spanish populations of three different species including: four cattle breeds, two of them (*Mallorquina*, MAL, and *Menorquina*, MEN) bred in the Balearic Islands and the others in the Peninsula (*Pirenaica*, PIR, and *Serrana de eruel*, ST), four ovine breeds, two of them bred in the Balearic Islands (*Roja Mallorquina*, RMAL, and *Menorquina*, MEN) and two in the Peninsula (Ansotana, ANSO, and *Rasa Aragonesa*, RASA), and a goat breed bred in the Balearic Islands too (*Mallorquina*, MALL). The aim of this work was to characterize these breeds in terms of genetic variability and to analyse their genetic relationships with other Spanish populations.

Materials and methods

A total of 425 animals were sampled, 174 from the cattle breeds MAL (28), MEN (50), ST (44), and PIR (52), 201 from the ovine breeds RMAL (50), MEN (50), ANSO (43) and RASA (58) and 50 from the goat breed (MALL), avoiding relationship between them whenever was possible. In some cases, the reduced population size made selective sampling impossible.

DNA was extracted from blood using standard protocols and the GF ^{TM} Genomic Blood DNA purification kit (Amersham Biosciences). Thirty microsatellite loci were analysed in the different populations of cattle, and fifteen in the ovine and goat ones, all of them were selected for diversity studies in cattle, sheep or goat by the FAO. Microsatellite allele sizes were differentiated and visualized using α ^{32}P -dCTPs in the PCR and 6% denaturing polyacrylamide gel electrophoresis, and also using the ABI PRISM 3130 genetic analyser (Applied Biosystems, Foster City, CA, USA). The internal size standard used was LYS-250 and the software Genemapper 3.7 (Applied Biosystems) were used for sizing alleles. Moreover, some control samples from the ISAG and Resgen Project were also genotyped in order to ensure compatibility of our nomenclature with other research groups**.**

Allelic frequencies for 21 common microsatellites with a previous study (Mart n-Burriel *et al*., 1999) have been used for genetic differentiation and genetic relationship analysis in cattle. The four breeds studied were compared with other seven Spanish populations (*Casta Navarra*, CN, *Beti u*, BET, *Monchina*, MON, *Avile a*, AV, *Asturiana de las Monta as*, AM, *Morenas del Noroeste*, MNO, and *oro de Lidia*, TL).

Allele frequencies for each locus were calculated by direct count using the program GENEPOP (Raymond and Rousset, 1995). This software was also employed to carry out a probability test to determine possible deviations from Hardy-Weinberg proportions. A Markov chain method was applied to calculate exact P-values, the length of the chain was set to be 100,000 iterations.

The mean number of alleles per locus, unbiased (Nei, 1978) and direct count estimated heterozygosities and the percentage of loci polymorphic, when the frequency of the most common allele was lower than 0.95, were calculated in each population using GENETI (Belkhir *et al*., 2004).

BOTTLENECK program (Cornuet and Luikart, 1996) was run to evaluate the possibility of a recent reduction of population effective size leading to a temporary excess of heterozygotes. A two-phased model of mutation (TPM) consisting of 90% of one-step mutations (SMM) was applied, as recommended for most microsatellite loci (Di Rienzo *et al*., 1994). To determine whether a population exhibits a significant number of loci with gene diversity excess or deficiency a Wilcoxon sign-rank test was applied (Luikart, 1997).

D_A distance (Nei *et al*., 1983) was also estimated for genetic differentiation. This measurement, based on a model of pure genetic drift, has been successfully applied to the genetic differentiation of breeds using microsatellite loci (Kantanen *et al*., 2000 Kim *et al*., 2001). Phylogenetic trees were constructed by Neighbour-joining (NJ) clustering (Saitou and Nei, 1987) from D_A distances using the PHYLIP package. The robustness of dendogram topologies was evaluated by bootstrap resampling (n=1000). The computer program DISPAN (Ota, 1993) was applied for D_A calculations.

Results and discussion

Genetic characterization of cattle breeds

All microsatellite loci were polymorphic (at 95% level) in every population except SPS115 and

HEL13 in MAL. Predominant alleles differed across populations and the number of Taxon specific alleles (TSA) ranged from 3 to 10, in MEN and ST breeds, respectively. Frequencies for rare alleles were lower or equal to 0.05 in most cases.

Mean expected unbiased heterozygosity estimates, computed across all loci for each cattle population, are shown in Table 1. The heterozygosity values observed ranged from 0.52 (MAL) to 0.69 (ST). All populations showed statistically significant deviation from Hardy-Weinberg equilibrium (HWE) at one or more loci.

Table 1. Genetic variability values for six endangered Spanish cattle populations

Breeds	n†	Pol Loci (0.95) ††	MNA†††	TSA††††	Heterozygosity		HWE††††† deviations
					Expected (s.e.)	Observed (s.e.)	
MAL	28	0.900	3.227	2	0.4952 (0.2321)	0.5193 (0.2646)	1
MEN	50	1	5.267	3	0.6156 (0.1288)	0.6151 (0.1479)	4
ST	44	1	6.700	7	0.6997 (0.1323)	0.6924 (0.1504)	4
PIR	52	1	6.000	4	0.6170 (0.033)	0.5880 (0.034)	6

†n = number of individuals per population ††Pol Loci (0.95) = percentage of polymorphic loci at 95% level †††MNA = mean number of alleles per locus ††††TSA=Taxon specific alleles found in 4 Spanish cattle populations using 21 microsatellites markers †††††HWE deviations = number of loci showing deviations from Hardy-Weinberg Equilibrium.

Microsatellite loci showed a high variability in the four Spanish cattle breeds analysed in the present work. The total number of taxon-specific alleles detected in this study breeds when they were compared with other Spanish populations using 21 common markers was much higher than the one reported by Kantanen *et al*. (2000) Nordic cattle. Animals analysed in the present work were sampled from through-breed populations with a very low gene flow from other related breeds, increasing the probability of detecting taxon specific alleles.

Mallorquina population also displayed the lowest diversity values (mean number of alleles per locus and mean expected heterozygosity) and an excess of heterozygotes that could be due to the existence of a recent bottleneck. By contrast, Minorcan breed showed higher diversity values although its values were lower than those observed in other Spanish populations (Mart n-Burriel *et al*., 1999). The low level of intrabreed genetic variation observed these populations corresponds with the expected display of island breeds (MacHugh *et al.,* 1997). Serrana de Teruel, althought it is considered as endangered, has shown high diversity values as well as a very low imbreeding coefficient. Traditionally, this breed has been mainly influenced by Negra Avileña and to a smaller degree by other mountain type breeds of northern Spain (http://www.fao.org/dad-is). The admixture of these breeds might have contributed to the high variability observed now.

Genetic relationship with other Spanish cattle populations

D_A genetic distances ranged from 0.0672 to 0.3408 (data not shown). Considering this distance measurement, the closest breeds were found to be ST and MON, being MAL and MNO the most divergent populations. Distance estimates showed that MAL was genetically the most divergent breed.

High genetic distances were related to the risked status (reduced effective population size) of breeds and reproductive isolation rather than with geographical distances. The phylogenetic tree obtained (Fig. 1) is in agreement with the expected relationship between breeds. On the other hand, although Balearic populations (MAL and MEN) are also grouped, distances between these two breeds were similar to those observed with other Spanish populations. Its risked status and geographical isolation could explain the great divergence.

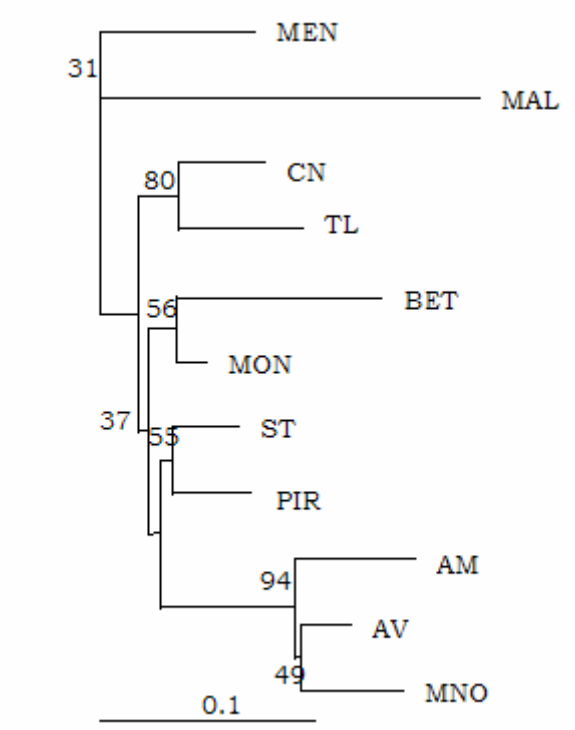

Fig. 1. Unrooted NJ network derived from the D_A genetic distance among 11 Spanish cattle breeds.

Genetic characterization of small ruminants populations

A total of 453 alleles were observed in the four Spanish ovine populations studied, the number of alleles observed at a single locus ranged from 4 to 15 (Menorquina), while a total of 87 alleles were observed in the goat population, and the number of alleles observed at a single locus ranged from 2 to 9. The ovine populations were compared using the allelic frequencies from 15 microsatellites and some Taxon specific alleles were found (Table 2). Normally, allelic frequencies were low, but some alleles showed higher frequencies, so these ones together with the Taxon specific alleles resulted to be ideal for new assignation of individuals to these breeds.

Table 2. Genetic variation in the ovine breeds Roja Mallorquina, Menorquina (20 loci microsatellite), Ansotana and Rasa Aragonesa (27 loci microsatellite), and in the Mallorquina goat breed (15 loci microsatellite)

	Sheep				Goat
	Roja Mallorquina	Menorquina	Ansotana	Rasa Aragonesa	Mallorquina
n†	50	50	43	58	50
Pol Loci (0.95) ††	1	1	1	1	1
MNA†††	7.55	7.90	7.48	8.85	5.80
TSA††††	5	2	2	9	-
Mean heterozygosity	0.707	0.680	0.706	0.690	0.507
HWE deviations†††††	1	3	7	2	4

†n = number of individuals per population ††Pol Loci (0.95) = percentage of polymorphic loci at 95% level †††MNA = mean number of alleles per locus ††††TSA = Taxon specific alleles found in 4 Spanish sheep populations using 15 microsatellite markers †††††HWE deviations = number of loci showing deviations from Hardy-Weinberg Equilibrium.

Observed and expected heterozygosity values were similar in every sheep population. These values were high, around 0.7 (Table 2), displaying also a large mean number of alleles per locus. Neither an excess nor a deficiency of observed heterozygotes with respect to the expected values, was observed.

Most of the microsatellite markers were in Hardy-Weinberg equilibrium in the sheep populations, except for Ansotana breed where the 26% of loci showed deviations from equilibrium. On the other hand, 100% of loci were polymorphic, at 95% and 100% level in both. These results indicate that the sheep populations analysed show a high genetic variability. These breeds will not be in risk if their effective size is maintained.

Nei D_A distances between sheep populations (data not shown) were calculated and used to create a phylogenetic tree grouped (Fig. 2). The obtained dendrogram grouped the two island breeds and the two peninsular populations in different clusters.

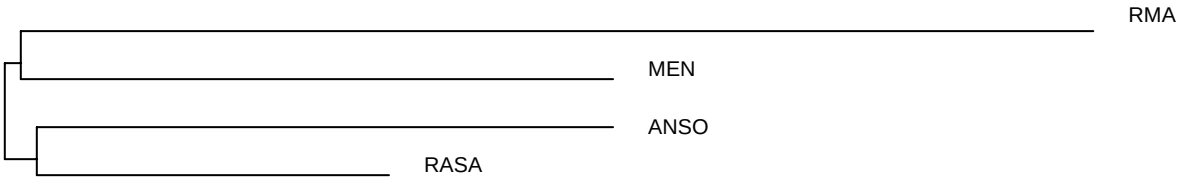

Fig. 2. Phylogenetic tree showing the genetic relations between Roja Mallorquina, Menorquina, Ansotana and Rasa Aragonesa ovine breeds, using the D_A genetic distance and the Neighbour-Joining algorithm.

The goat population studied (Mallorquina) showed diversity values lower than the ones observed for sheep populations, although all microsatellite markers were polymorphic.

Finally, Mallorquina goat population displayed an expected heterozygosity (H_E = 0.597) higher than the observed value (H_O = 0.507). Moreover, 26.67% of loci showed deviations from Hardy-Weinberg equilibrium. The loss of variability would be a consequence of a high imbreeding, as this breed is being considered in risk and it is geographical and reproductively isolated.

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Les nouvelles stratégies et les perspectives de l'élevage **traditionnel au Maroc dans le conte te de la mondialisation**

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RESUME – Au Maroc, l élevage conna t un regain d intérêt et, c té des grandes étables modernes, une intensification, tant chez les pasteurs que chez des petits spéculateurs villageois. L intégration au marché généralisée n implique un souci particulier d amélioration de la qualité que pour une minorité. Des encouragements dans le sens de l'amélioration de la qualité ne peuvent être utiles que si les accords internationaux d ouverture du pays l importation de viande ne prennent pas effet dans un avenir trop proche.

Mots-cl s : Maroc, revenus, élevage pastoral, marchandisation des animaux, métier de berger, mutation des valeurs techniques, libre échange.

SUMMARY – *"Ne strategies and prospects for traditional production systems in Morocco in the context of globali ation". In Morocco, a rene al of the interest for stock husbandry is developed among pastoralists as ell as small scale o ners, basing on intensification and sale focused systems. o ever, integrating the market economy means more concern for quality improvement only for a fe breeders. Incentives to achieve such a progress can only be useful if the recent agreements allo ing meat imports do not come into effect in the near future.*

Keywords: *Morocco, livelihood, pastoralists, merchandi ing livestock, shepherd skills, change in technical values, free market.*

Le cheptel se stabilise et susc te un int r t nouveau

Au Maroc, la productivité bouchère et laitière générale de l élevage a augmenté entre le début et la fin du ème siècle, notamment depuis les années 1970. Cela se manifeste aussi bien dans l importance prise par l industrie de traitement du lait que dans le poids moyen des animaux abattus au cours d une année, qui a augmenté partout, sauf dans les provinces du piémont sud du Haut Atlas (Annuaires Statistiques, Direction de la Statistique).

Le cheptel a évolué de fa on inégale (Annuaires Statistiques, Direction de la Statistique), mais les variations liées l aléa climatique se sont progressivement atténuées avec l encadrement de l Etat, vaccination massive entamée dès le début ème du siècle et définitivement adoptée dans la majorité des régions dans les années 1980, actions d encouragement l amélioration génétique et l apport d aliments issus des cultures ou de l industrie partir de 1960 et de1970. L effectif des ovins suit une tendance générale l augmentation et l atténuation des pertes lors des crises, dans leur ensemble bioclimatiques. La diminution des effectifs des bovins est nettement le résultat d un équilibrage entre la taille du troupeau et la généralisation de l élevage d animaux de races hautement productives ou de leur croisement avec des souches locales. L effectif des caprins reste marqué par des fluctuations au gré des avatars des conditions climatiques et économiques, des mesures de protection de la nature et des actions de promotion commerciale(Chiche, 1998).

Aujourd hui, si l agriculture garde une place importante dans l économie du pays, si les activités et les revenus des ruraux restent fondés sur les cultures et l élevage, si la combinaison traditionnelle entre ces deux secteurs subsiste, non seulement le Maroc reste parmi les pays o l élevage continue dominer les activités de la plupart des régions, mais il semble que, depuis le milieu des années

[1] J adresse tous mes remerciements A. Bourbouze qui a accepté de relire ce texte et de me faire des commentaires précieux.

1990, l occupation de la terre soit arrivée un stade de saturation qui amène de nombreuses catégories de marocains s orienter plus fortement vers des investissements dans l élevage.

Le débat ouvert entre, d une part, tenants d une conduite visant l augmentation de la production (en quantités de lait, en poids des animaux et de leur cro t, en augmentation de leur conformation), d autre part, partisans du privilège de la rusticité, prend alors toute son importance. Il se poursuit en effet dans le sens de la définition des critères de : (i) durabilité des systèmes de production en y englobant la qualité de la vie, la qualité des écosystèmes et la conciliation entre les deux et (ii) qualité des produits, avec des préoccupations sur la compétitivité de ces produits dans le contexte actuel d intégration au marché mondial.

L analyse qui suit traite essentiellement de l évolution des stratégies dans les systèmes d élevage traditionnels. Les systèmes de production de lait et de viande introduits principalement dans le dernier tiers du ème siècle sont étudiés dans le même esprit par M. T. Srairi.

Les strategies ne sont plus fond es sur des consid rations pastorales

Le cheptel de rente du Maroc est composé de près de 2,500,000 de bovins, 16,500,000 d ovins et 5,500,000 de caprins. On peut estimer qu une part infime des bovins, autour de 2/3 des ovins et 1/5 des caprins font partie de grands élevages pastoraux ou associant p turage et alimentation apportée et que respectivement 10%, 1/3 ou plus, et 2/5 de chaque espèce sont élevés par des petits ruraux.

Tous les systèmes d élevage ont connu des modifications très rapides. Avant d analyser les stratégies qui ont entra né ces mutations, passons en revue la situation de chaque type de système.

L élevage activité principale

L élevage pastoral, dominance d ovins ou de caprins, sur parcours collectifs, reste une des activités centrales dans les forêts, maquis et steppes du Moyen Atlas et de son pourtour, o les bovins tiennent une place notable, et dans la zone aride, steppes de l Oriental et du piémont sud du Haut Atlas et zone saharienne, o le dromadaire garde sa valeur. Les agriculteurs des plaines atlantiques moyennes et du versant nord du Haut Atlas qui ont des grands troupeaux utilisent toujours des p turages collectifs plus ou moins proches de leurs terres cultivées. Ce sont cependant tous ces systèmes qui ont le plus changé la fin du ème siècle.

Le déplacement des troupeaux est soit réduit, soit allongé et fait par camion, entre des lieux isolés les uns des autres par des distances per ues en temps et non d après les milieux physiques et humains traversés. Le choix des régions o on envoie les troupeaux ne se fait plus uniquement en fonction de l état des p turages et des ressources en eau mais aussi des prix sur les *souqs* de différentes régions. Des propriétaires divisent leur cheptel en plusieurs troupeaux qu ils envoient chacun près d un *souq* entre lesquels ils font des tournées de prospection, prenant plus en considération, dans le choix des bêtes vendre, les prix sur les différentes places que la valeur des animaux liée leur qualité.

Le ème siècle a ainsi été l époque d une généralisation progressive du passage de l organisation de la conduite des troupeaux par rapport aux cycles biologiques des stratégies con ues autour de la vente. La nécessité professionnelle de symbiose entre les bergers, leurs animaux et leur milieu est en en déclin accéléré. Le vocabulaire de l élevage pastoral, naguère familier tous, est totalement inconnu des jeunes et ne trouve d écho que chez les personnes gées.

Dans la Moulouya, il y a encore dix ans, on vendait essentiellement des agneaux avant la période sèche, alors qu aujourd hui l *aid el kebir* a pris sa place dans les stratégies et, que, depuis 1994, ont été introduits au milieu de la steppe aride des bovins, qui plus est Holstein, dont les effectifs augmentent progressivement. Aujourd hui, deux modes de conduite sont menés de fa on plus ou moins articulée, sans séparation géographique entre des élevages naisseurs et engraisseurs. Le troupeau pastoral est mené sur les parcours. Mais, partout, les produits achetés sont entrés dans son alimentation, bien que leur utilisation ne dure plus de 2 4 ou 6 mois que lors des longues sécheresses, ainsi que pour les vaches, et que leur part ne dépasse 30% de la nourriture de

l ensemble du troupeau, femelles comprises, que chez une minorité. Les femelles en fin de gestation et venant de mettre bas, pour la plupart en hiver, re oivent de faibles rations de concentré, de l ordre de 100g/jour dans le sud-ouest, de 350g/jour ailleurs. La majorité des agneaux sont vendus 4 ou 5 mois, avant que les parcours s appauvrissent. Une partie est soumise, avec d autres jeunes, m les et femelles, une alimentation renforcée, o la complémentation est plus ou moins importante selon l état de la végétation. On cherche, en fait, de plus en plus planifier les calendriers de l alimentation et de la reproduction selon le rythme de la variation des prix, en achetant des agneaux pendant les périodes o les cours baissent et en les mettant l engraissement pour les vendre quand le marché est la hausse, et des antenais 1 2 mois et demi avant les périodes o une forte demande d animaux est certaine. Cela est cependant difficile ma triser. Les périodes pour lesquelles on peut être s r que la demande est forte sont le plein été et le début de l automne, époque des retours en vacances et des mariages et, éventuellement, des grandes fêtes agricoles et de pèlerinage (*moussem*). Les autres occasions de sacrifice d animaux et de consommation de viande rouge sont l *aid el kebir*, cérémonie mobile par rapport au calendrier saisonnier et les baptêmes, dispersés au cours de l année.

Les troupeaux sont constitués d animaux dits de type *beldi* (local), acclimatés leurs territoires habituels, résultant de croisements diffus au cours des siècles. Aujourd hui, seuls les pasteurs Moyen Atlas ne font pas de croisements, dans un esprit de valorisation de la *imahdit*. Partout ailleurs, l apport de sang de races de haute stature prend de l importance. Le *sardi* domine, en particulier dans les plaines atlantiques, o il a fortement oblitéré la souche *Beni assen*, mais aussi, plus récemment, dans l Oriental, o la *Ouled Jellal* est aussi prisée, sur le versant sud du Haut Atlas et, avec des réserves de l ordre de la rusticité, dans le sud-ouest. La sélection des géniteurs par un suivi des animaux selon les normes pastorales et la qualité de leur cro t a pour résultat la permanence de types viables en zone semi aride et aride.

L élevage capitalisation sur une courte durée

Des agriculteurs, ou d autres personnes, immobilisent pour une courte durée des gros bénéfices dans l achat d un troupeau important, en général ovin, qu ils destinent être revendu pour financer un investissement, dès qu une opportunité se présente. Ces troupeaux sont conduits extensivement.

Les petits eux aussi évoluent vers une affectation de l élevage des revenus

L élevage caisse de secours

Les troupeaux de moins de 10 ovins ou caprins constituent un capital épargne d assurance en cas de manque d argent pour des personnes vivant d activités très peu rémunérées ou précaires. Ce type de stratégie met en uvre deux modes de conduite de l élevage.

Les membres des familles démunies ne trouvent de travail salarié que pendant une partie de l année. Le peu d animaux que possèdent une grande partie de ces familles sont conduits extensivement un co t minime. Ils paissent sur les bords des routes et autour des maisons. La consommation des familles provient essentiellement d achats, crédit, en particulier pendant la période d émigration, au terme de laquelle les commer ants savent qu ils pourront être payés. Pendant les périodes o les hommes n ont pas d emploi, la subsistance repose en particulier sur la vente du ou des jeunes animaux, antenais, puis cro t de l année, en général un un.

Dans les oasis et les villes du sud, dans les villages du nord, des tout petits agriculteurs et des travailleurs et retraités petits revenus mènent l élevage domestique d 1 ou 2 brebis, 1 4 chèvres. Une des qualités reconnues ces animaux est leur bonne prolificité, liée tant leurs caractères génétiques qu leur conduite intensive, fondée sur une alimentation recourant peu au marché, équilibrée dans les oasis et dans le nord, plus pauvre en fourrage vert dans les villes. Ils sont destinés principalement l autoconsommation, et la possibilité de faire face un manque d argent ou une dépense imprévue en vendant une trois bêtes.

Les animaux de ces deux types d élevage ne sont donc, dans leur ensemble, conduits ni selon un calendrier planifié, ni selon les normes d une qualité bouchère particulière. Aussi sont ils vendus dans un état chétif L état de chacun la livraison au boucher revient la décision du maquignon qui

choisit, entre les animaux qu il a achetés, de vendre directement des bouchers ceux qui sont les plus mal en point et de proposer aux éleveurs et engraisseurs ceux qui sont sains. On ne peut donc considérer cet élevage comme naisseur selon les normes élémentaires de qualité.

L élevage de fructification de petits revenus

Des personnes qui ont des revenus modestes mais soit réguliers, soit saisonniers mais plus élevés que les précédents, peuvent pratiquer un élevage plus conforme aux normes courantes du marché. Ils investissent l essentiel de leurs salaires dans l engraissement de veaux et d agneaux de fa on faire fructifier leur faible revenu de base.

Les employés qui ont des revenus réguliers, donc un fonds de roulement continu au cours de l année, achètent, engraissent et revendent un veau par mois, ou deux une demi douzaine d agneaux par quinze jours. La vente et les dépenses d une conduite visant la boucherie sont des postes budgétaires réguliers. Les normes préconisées par la zootechnie sont intégrées aux références de ces éleveurs. Leur effort pour minimiser les co ts consiste essayer de payer le moins cher possible les moyens de production et non extensifier la conduite en limitant les rations en de d un seuil d acceptation par les maquignons ou par les bouchers si la vente se fait directement. uand la ration est diminuée, c est en vertu d un choix (ou de l acceptation) de vendre sur des places moins rémunératrices.

Les ouvriers saisonniers qui retournent chez eux avec des gains suffisants achètent une vache pleine, l engraissent pendant une courte durée avec le veau qu elle produit et revendent les deux animaux. Le produit de la vente assure les moyens d existence de leur famille jusqu la saison de travail suivante[2]. L élevage est conduit selon le même principe d intensivité et de recherche du prix le plus élevé sur le marché local. Il est cependant moins ma trisé, moins con u selon des normes zootechniques. L entreprise d un petit atelier est la mise profit d une opportunité commerciale sur une durée la plus courte possible.

Dans ces deux types d élevage, la vente d animaux vise faire fructifier un revenu de base qui n est ainsi plus un moyen de subsistance mais une source d investissement. La relation entre le travail salarié et l élevage spéculatif n est pas de complémentarité entre deux sources de revenus. La stratégie est celle de l articulation entre deux postes d un système de spéculation.

L levage s est int gr au march mais est menac

Le cheptel tient ainsi une place importante dans les budgets de pratiquement tous les Marocains ruraux. Les trois formes de contribution aux comptes ont cependant des implications techniques différentes. La vente d animaux jeunes concerne des systèmes o la rémunération des facteurs est faible. Elle a surtout des raisons zoo écologiques (délestage des p turages), son objectif économique est secondaire. Dans les stratégies o la vente ne s inscrit pas dans une logique d entreprise de production mais se fait pour répondre un besoin d argent, la conduite repose sur des dépenses et des préoccupations de qualité pratiquement nulles. C est l engraissement d animaux pour la boucherie qui suit le plus les normes de conduite et de qualité en vigueur sur le marché. Les liens avec le marché se sont toutefois renforcés dans tous les systèmes d élevage. Le facteur semble en être un renforcement de la demande lié la densification du réseau urbain et de l installation de boucheries. La conduite et les mouvements des animaux sont plus con us selon un calendrier de la consommation de viande qu en fonction du rythme des saisons et de la croissance des animaux. A part les plus démunis, tous achètent des animaux, pour les mettre l engraissement.

L apport de concentrés a été encouragé par des mesures de subvention de l Etat pendant une trentaine d années, mais aussi favorisé par la motorisation, qui a permis le report sur les animaux de rente de l orge et de la paille jusqu alors réservées aux animaux de transport et de traction. Toutefois, la complémentation et l amélioration génétique ont été adoptées moins comme moyen de renforcer la

[2] Cette spéculation se pratiquait déj au début du VI^{ème} siècle. Léon L Africain (1550) raconte que des ouvriers du Sud qui travaillaient Fes achetaient sur la route de leur retour un cheval qu ils revendaient la hausse des caravaniers dès leur arrivée chez eux.

vigueur et la résistance des animaux, mis au premier plan par les organismes d encadrement, que comme technique visant maximiser la production en contrecarrant les contraintes naturelles, de la même fa on que dans le mara chage de contre saison.

La nouvelle place que gagne ainsi l élevage dans les dépenses des producteurs, les amène chercher minimiser le plus possible le co t de la complémentation. Ces dernières années, ceux qui ont de la terre, élargissent leur sole fourragère aux dépens de cultures jusqu alors plus rémunératrices. Mais la technique générale est la recherche de la ma trise de la période et de la durée de l apport d aliments en fonction des variations de leurs prix par rapport ceux des animaux. Cela donne un avantage aux plus petits ateliers d éleveurs bien insérés dans leur milieu, qui peuvent bénéficier du suivi de l offre et de la demande que leur permettent des relations de proximité avec les maquignons et les bouchers.

Par ailleurs, cette nouvelle orientation implique le remplacement par des animaux de plus grand gabarit ou plus prolifiques des types, et même des espèces, adaptés aux conditions de chaque lieu pendant des siècles d acclimatations et de métissages diffus. Le passage d une préférence pour les ovins au lieu des caprins se fait lentement dans le Haut Atlas occidental dans certaines parties du nord. L élevage spéculatif de bovins gagne partout, y compris dans la steppe. Ces espèces et types plus productifs ont des exigences alimentaires et vétérinaires plus importantes.

Enfin, non seulement le temps affecté l élevage parmi les activités diminue (avec des nuances régionales), mais la compétence voit son rang de première qualité d un berger se perdre. Dans la situation actuelle de crise de l emploi et d autonomisation des fils par rapport leurs pères, les propriétaires de grands troupeaux et les éleveurs ayant une autre activité principale ont peu de mal trouver des personnes prêtes exercer le métier bergers. Les propriétaires de petits effectifs privilégient le recrutement d un enfant de 10 14 ans, placé par son père, pouvant justifier un bas salaire par une faible exigence de compétence et par un statut implicite d apprenti. Dans les grands élevages pastoraux, la bonne ma trise des relations entre les animaux et leur milieu naturel reste, en principe, une exigence fondamentale. Elle ne pose pas de problème dans le Moyen Atlas, o les bergers sont toujours des immigrants du sud-est, o la compétence pastorale reste une valeur et o ce n est que récemment que la construction économique et sociale commence être fondée sur d autres activités que la constitution d un troupeau en s engageant comme berger. Dans l Oriental, malgré les mutations qui se poursuivent depuis le milieu du ème siècle, subsistent des relations hiérarchiques traditionnelles entre groupes prestigieux de chefs d élevages et groupes faisant partie de leur clientèle qui leur sont attachés comme bergers. Ailleurs, dans le sud-ouest, dans les plaines et plateaux atlantiques moyens, o d autres valeurs et activités ont pris plus d importance, l origine n est plus privilégiée comme garantie de capacité. Les bergers sont recrutés sans référence sur l aire d embauche des ouvriers (*mouqaf*) d une ville et gardés ou renvoyés après une mise l essai de trois jours.

Les activités qui prospèrent, dans ce nouveau contexte, sont le commerce des aliments, secondairement les industrie et la médecine vétérinaire, mais, surtout, le transport, tant d animaux que de moyens de production et de produits de l élevage.

En définitive, la majorité des éleveurs ne vont dans le sens ni d un renforcement de la rusticité des animaux, ni d une recherche d une qualité particulière reconnue. Dans leur souci d offrir des animaux plus ou moins proches de la conformité la demande du marché, ils font, pour obtenir les produits qu ils écoulent rapidement, des croisements industriels partir de m les et de femelles de souches bien cotées sur le marché, qu ils s attachent conserver purs et sélectionner. Mais la qualité bouchère visée n est pas très élevée (Tableau. 1). La majorité des éleveurs de tous les systèmes livrent la consommation les bêtes sélectionnées comme les plus mauvaises, non seulement faibles ou stériles, mais aussi malades, ou vieilles, sans distinction entre les m les et les femelles[3].

Les systèmes évoluent donc vers une rupture avec un ordre qui dominait encore il y a dix ou vingt ans. Ils sont désormais fondés sur une séparation entre, d une part, le travail et la compétence, d autre part, le capital qu est le troupeau producteur, et le produit, cro t commercialiser, alors que dans les systèmes traditionnels, le travail était un métier, indissocié de la vie familiale et sociale, et les brebis étaient la fois des produits et un capital.

[3] Les femelles sont considérées, en principe, comme impropres la consommation, peut être sous l influence de la réglementation élaborée au début des années 1930 pour protéger le troupeau.

Les critères de qualité sont devenus, pour les animaux, le prix proposé par les acheteurs, l absence de signes de maladie, le poids, alors que, pour la viande, ce sont (comme dans tous les pays), l aspect, couleur, texture, la tendreté, en relation avec la durée de cuisson nécessaire et, plus récemment, la proportion de graisse, selon une appréciation contradictoire entre valorisation du maigre ou du bien gras (Sarter). L hygiène et le go t sont des qualités couramment mises un rang secondaire dans les faits, bien qu ils soient fortement mis en avant dans les discussions individuelles sur les préférences et dans les campagnes de promotion de produits.

Tableau 1. Le poids des animaux abattus en 2004 (Direction de la Statistique et abattoirs)

Abattoir	Poids moyens (en kg) des animaux abattus		
	Bovins	Ovins	Caprins
Casablanca	140 180	16 20	14,5
Rabat	267,7	13	12,5 13
Tamanar	92 115	9 18	5 7
Zeida	110 150	9 12	7 8,5

Ces normes ont pour conséquence une tendance la dépréciation des souches des montagnes et des plaines c tières moyennes au profit de races de belle conformation, essentiellement de la *sardi*, introduites dans un but d amélioration, même dans les régions aux conditions écologiques les plus contraignantes, et même si cela doit aggraver les problèmes de co t de la conduite. Cependant, c té de différences de prix entre régions, la permanence d un marché d animaux chétifs destinés la consommation et l élevage locaux c té d un marché de produits de belle allure confirme l existence de deux marchés, l un alimenté par des éleveurs pauvres ou peu intéressés par l élevage et destiné des consommateurs au faible pouvoir d achat, l autre orienté vers une clientèle demandeuse de produits répondant aux normes de qualité actuels. Ainsi, le niveau de la consommation reste faible tandis qu il augmente pour la volaille et le poisson (Tableau 2).

Tableau 2. volution de la consommation de viandes

Consommation en kg/personne/an				
	1960	1971	1985	2001
Viande rouge	11,0	13,8	9,0	10,5
Volaille	1,4	2,3	5,6	7,1
Poisson	3,5	3,2	6,1	8,6
Total	15,0	19,3	20,7	26,2

Source: Enquêtes Consommation et Dépense des Manages, Direction de la Statistique).

Dans ces conditions o un marché moderne du bétail commence peine se structurer, la mission des services d encadrement et de coordination devrait être d orientation et de contr le des pratiques dans le sens du respect des règles d hygiène et de la conception de modèles de qualité.

On revient cependant des interrogations sur l efficacité de tout l effort d amélioration de la viande et du lait si l ouverture du marché marocain aux produits de pays gros producteurs prend effet. Il est vrai que jusqu présent, et depuis le début des années 1930, les producteurs de viande, surtout bovine, ont réussi faire pression sur tous les projets d importation. Mais il faut se demander quelle place font les dispositions actuelles du commerce international la production nationale c té des importations. Les perspectives ne devraient pas alors être envisagées uniquement en termes de difficultés économiques qui frapperaient les éleveurs, mais aussi de possibilité de bonne organisation

du transport et du froid et vers des analyses comparatives entre co ts et bénéfices économiques et sociaux.

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Stocking rate increase based on pasture improvement in the Maestrazgo Region of Teruel (NE Spain)

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SUMMARY – The aim of this work is to improve pasture production in the semiarid mountain areas in the North-eastern Iberian Peninsula in order to optimize the management of livestock farms. Three experiments were carried out: (i) pasture improvement of abandoned fields invaded by Genista scorpius (L.) DC by clearing and mineral fertilization; (ii) establishment of sown meadows; and (iii) improvement of drought grasslands by mineral fertilization. The annual average yields obtained in these experiments were 1439, 4291 and 3948 kg DM/ha, respectively. Eighty percent of the forage yield was obtained in the May-July period and the remaining in September. Therefore, animals were short of pastures at least six months a year. Present stocking rate is 0.21 LU/ha, and it could be increased to 0.32 LU/ha, if pasture production is improved.

Keywords: Mountain pasture, semiarid areas, forage yield, clearing.

RESUME – "Augmentation de la charge animale au moyen de l'amélioration des pâtures dans le Maestrazgo Turolense, NE d'Espagne". On essaie d'améliorer la gestion des pâtures de montagne dans les zones semi-arides du Nord-est de l'Espagne par l'augmentation de la production de fourrage. Pour atteindre cet objectif on a effectué trois expériences : (i) débroussaillement mécanique de l'arbuste envahissant Genista scorpius (L.) DC en champs abandonnés et fertilisation minérale ; (ii) semis des prairies ; et (iii) fertilisation minérale d'une prairie naturelle. La production moyenne annuelle de fourrage dans ces expériences a été de 1175, 4291 et 3948 kg MS/ha, respectivement. Les 80% ont été obtenus pendant la période mai-juillet, et le reste jusqu'en septembre, donc les animaux ne disposent pas de pâtures au moins six mois dans l'année. La charge animale actuelle de 0,21 UGB/ha, pourrait arriver à 0,32 UGB/ha sans avoir besoin de ressources fourragères ou de concentrés de l'extérieur, si les terres de culture actuelles étaient destinées à des prairies et cultures fourragères.

Mots-clés : Pâturage montagneux, terres semi-arides, ressources fourragères, débroussaillement.

Introduction

The Maestrazgo Turolense is located in the North-eastern Iberian Peninsula between latitudes 40º20' and 40º50' N and longitudes 0º20' and 1º20' W. It is a mountainous area with 96% of the land at 800-1800 m altitude. Its surface is 354,550 ha and the population 12,469 inhabitants in 2005 (IAEST, 2005). Its average annual rainfall is 400-700 mm and the temperature 8-10ºC. However, the extreme lowest temperatures may reach -20ºC. Soil is mainly limy with more or less horizontal and fractured stratification, what has given place to an intense karstification with slight retention of rainwater.

Extensive livestock is clearly an option in this region because its location, far from highly populated areas, mountainous orography, high altitude and semi-arid climate do not favour intensive agriculture. Soils occupation is as follows: agricultural lands, 30,999 ha; dry grasslands, 137,782 ha; forested mountains, 127,288 ha; other surfaces, 54,810 ha. From agricultural lands, herbaceous crops cover 12,599 ha, 89.7%devoted to cereals. Fallows and abandoned lands susceptible of grazing sum up 16,317 ha. Sheep farming is dominant with 120,072 heads, followed by cattle with 10,252 heads, while goats are not relevant (3,380 heads) (Departamento de Agricultura y Alimentación, Gobierno de Aragón, unpublished data). On the other side, extensive livestock shapes the mountainous landscape in a mosaic pattern, with grasslands and cultured fields interspersed with pine forests and shrubland in the steepest areas that besides attracting tourism, makes the diversity and preservation of the flora and fauna feasible, and the expansion of fires more difficult.

However, the agricultural activity has decreased in the last years due to the population decrease or abandonment of farming, changing to other activities such as intensive pigs farms or tourism. This fact has led to a drastic decrease of the livestock that profits from these areas vegetal resources with the corresponding landscape transformation (Flores *et al.,* 2002 2003). One of the problems due to the land abandonment and the reduction of the stocking rate, overall sheep and goats, has been the decrease of grazing area caused by the increment of thick bushes in plots previously used for grazing purposes.

One way of promoting extensive livestock would be improving the yield and use of pastures. The aim of this work is to know the grazing potential of grasslands in the Maestrazgo Turolense in order to favour the design and management of livestock farms.

Material and methods

Three experiments were carried out.

Experiment 1. Pasture improvement of abandoned fields invaded by *Genista scorpius* (L.) DC

The experiment was carried out at G dar (latitude 40 28 N longitude 0 39 W altitude 1481 m) and Cantavieja (latitude 40 32 N longitude 0 26 W altitude 1200 m), in formerly cultured plots now abandoned and covered 80% and 67.5% respectively by shrubs with dominating *Genista scorpius* (L.) DC, in the 1998-2001 period.

The extreme values of monthly average maximum and minimum temperatures were 28.7 C and -1.9 C, with an absolute minimum of -9 C at Cantavieja 27.6 C and -5.8 C, with an absolute minimum of -12.5 C at G dar. Annual rainfall ranged 390.9-672.7 mm at Cantavieja and 464.9-859.4 mm at G dar.

The improvement consisted in clearing and an annual application of 250 kg of the complex 8-24-8/ha, at the end of the winter.

A comparative trial was established to evaluate pasture yield. The statistical design was random blocks with three repetitions in 60 m^2 and 100 m^2 plots at G dar and Cantavieja respectively.

The species, stocking rate and grazing programme were the same as before clearing. At Cantavieja, grazing was practiced with meat cattle from July to October. Stocking rate was 0.27 heads/ha/year. At G dar, the same type of cattle grazed from May to July and from October to December with a stocking rate of 0.16 heads/ha/year.

Herbaceous biomass was measured within the comparative plots, at the cattle entrance and issue, by harvesting four 0.25 m^2 squares at random/plot at 1 cm from the soil. Also, a 0.5 m^2 exclusion cage/plot for the estimation of the total pasture production was placed. In the laboratory, the percentages of humidity by desiccation in a forced air chamber at 60 C were determined.

Experiment 2. Meadows establishment

The experiment was carried out at Fortanete (latitude 40 30 N longitude 0 31 W altitude 1352 m), in a rainfed, cultured plot in the 2002-2004 period.

The extreme values of the monthly average maximum and minimum temperatures in that period were 29.7 C and -4.8 C and the absolute minimum -14.3 C. Annual rainfall ranged between 528 and 684.4 mm. The analysis of soil texture and fertility at 0-30 cm depth provided the following results: loamy soil with basic pH, high organic matter contents and acceptable phosphorus and potassium levels.

The following species and varieties were studied: (i) Aragón lucerne, at a rate of 20 kg/ha (ii) sainfoin of Turkish origin, 150 kg/ha (iii) Ludac cocksfoot, 20 kg/ha (iv) Fuego tall fescue, 20 kg/ha (v) Ansyl Italian ryegrass, 20 kg/ha (vi) Aragón lucerne + Ludac cocksfoot, 10+10 kg/ha and (vii) Aragón lucerne + Fuego tall fescue, 10+10 kg/ha.

The trial was sown 23 May 2002, the plot measured 10 m^2 (2x5 m) and the statistical design was random blocks with four repetitions. As fertilization before seeding, 250 kg/ha of the complex 8-24-8 were applied.

Three cuts were practiced in the sowing year and three cuts the following years in May, July and September, when most species started blooming or ear emergence. One forage sample of 0.5 m^2 was desiccated in a forced air chamber at 60 C.

Experiment 3. Drought grassland improvement by mineral fertilization

The experiment was carried out at Fortanete (latitude 40 27 N longitude 0 32 W altitude 1400 m) in a drought grassland, in the 2002-2004 period.

The climatological conditions were similar to Experiment 2. The analysis of soil texture and fertility at 0-20 cm depth corresponds to a loamy-clayey-sandy soil, basic pH, with a high organic matter contents, poor in phosphorus and acceptable in potassium.

The following fertilizers were applied annually: (i) only N fertilization, at a rate of 50 UF/ha (ii) only phosphorus fertilization, 100 UF/ha (iii) only potassium fertilization, 100 UF/ha (iv) complex 8-24-8, 250 kg/ha and (v) control, not fertilized.

Elemental plots measured 25 m^2 (5x5m), statistically distributed in three blocks at random. A 0.5 m^2 exclusion cage was placed at each plot in order to record the biomass production. The experiment started 27 May 2002. Three cuts per year were practiced in June, July and October. The forage was dried in a forced air chamber at 60 C.

Results and discussion

The forage yield obtained in Experiment 1, in abandoned agricultural plots submitted to clearing was 1439 kg and 1211 kg DM/ha at Cantavieja and G dar respectively, when fertilized, and 911 kg and 738 kg DM/ha in non fertilized ones (Table 1). 77.4% of the forage yield was obtained till July and the remaining yield in the summer. Mineral fertilization improved yield significantly from the third year onwards.

The average forage yield, obtained in Experiment 2 by sowing species and forage mixtures was 4291 kg DM/ha distributed in three cuts: 50.2%, first cut made at the end of May 30.6%, second cut in the middle of July and 19.2%, third cut at the end of September (Table 2). Lucerne and its associations with cocksfoot and tall fescue stood out significantly because of their yield and persistence.

The average forage yield, obtained in Experiment 3 in a grass plot with different types of fertilization was 3948 DM kg/ha distributed in three cuts: 72.9%, first cut made at the beginning of June 17.3%, second cut at the end of July and 9.8%, third cut at the beginning of October (Table 3). Only mineral N fertilized plots stood out significantly with respect to non-fertilized ones, with 4563 kg *vs* 3709 kg DM/ha, as four-year average.

The obtained forage yields are similar or lower than those reached in cultured plots at other locations of Aragón with similar or lower rainfall than at the Maestrazgo Turolense (Delgado, 1984, 1995 Hycka and Armero 1990). Mineral fertilization scarcely contributed to improve forage production, what is attributed to the low capacity of carstic soils to keep moisture (Ferrer *et al.,* 1993).

Table 1. Herbaceous yield (kg DM/ha) in abandoned agricultural plots submitted to clearing at the beginning of the experiment and at the end of each year at Cantavieja and G dar (Teruel)

Location	Treatment	Date				
Cantavieja		2.3.98	10.11.98	6.10.99	18.10.00	24.10.01
Kg DM/ha	Fertilized	-	1428.2	1534.7	2488.9	304.1
	Non fertilized	-	1260.1	741.2	1351.4	292
Signification		-	NS	NS	*	NS
Annual rainfall (mm)		-	390.9	599.5	672.7	489.9
G dar		12.2.98	15.10.98	19.10.99	5.10.00	28.11.01
Kg DM/ha	Fertilized	-	448	1237.5	1678	1479.6
	Non fertilized	-	286	870	1139	655.9
Signification		-	NS	NS	*	*
Annual rainfall (mm)		-	479.1	718.4	859.4	464.9

NS = P 0.05 *= P<0.05.

Table 2. Forage annual yield (kg DM/ha) from different forage species and mixtures at Fortanete (Teruel)

Treatment	Total 2002		Total 2003		Total 2004	
	Total	% grass†	total	% grass†	total	% grass†
Lucerne	4915 [a]	-	6449 [abc]		5250 [b]	
Sainfoin	4432 [ab]	-	5310 [cd]		3743 [c]	
Cocksfoot	557 [d]	-	4090 [d]		1817 [d]	
Tall fescue	165 [d]	-	4161 [d]		2245 [d]	
Italian ryegrass	2073 [c]	-	5923 [bc]		3428 [c]	
Lucerne + cocksfoot	4311 [b]	0.4	7299 [a]	38.8	6386 [a]	47.5
Lucerne + tall fescue	4107 [b]	1.2	6853 [ab]	20.7	6589 [a]	33.8
Signification	***	-	***		***	
Rainfall (mm)	528		684.4		530.6	

***= P<0.001. Differences between numbers with the same letter are not significant (P 0.05).
†% grass = Participation of cocksfoot or tall fescue in the mixture.

Table 3. Annual forage yield (kg DM/ha) of a grass plot with different fertilizations at Fortanete (Teruel)

Treatment	2002	2003	2004	2005
Control	2144.4	5240.8	5266 b	2186
Only N	2536.7	5556.2	7216 a	2943.7
Only K	2297.5	4666.7	5322 b	2319
Only P	2541.9	5268.6	5445 ab	2120.3
Complex	2388.4	5163.9	5608 ab	2726
Signification	NS	NS	*	NS
Rainfall (mm)	528	684.4	530.6	

NS = P 0.05 *= P<0.05.

A percentage higher than 80% of the forage yield is obtained in the May-July period and the

remaining one till September. Therefore animals are short of pastures at least six months a year, thus needing off-farm feeding and a grazing of fallows and shrubland as stated in the survey made to farmers by Flores *et al*. (2002 and 2003). Approximately, farmers buy off-farm 50% of feeding.

Present stocking rate at the Maestrazgo Turolense is 0.21 LU/ha, estimated from the present surface of grasslands. If we consider the forage yields obtained in previous experiments and that all cultivated lands are devoted to sown meadows and forage crops, the potential stocking rate of the Maestrazgo Turolense is 0.32 LU/ha, assuming a forage availability of 13.4 kg DM/LU/day in sown meadow and forage crops and 20 kg/LU/day in drought grasslands. This means that the stocking census could increase 83% LU and that only 45% of their forage possibilities are being used. Similar conclusions were presented by Ferrer *et al*. (1993) for the Maestrazgo Castellonense. These authors showed that the stocking rate was 47% of the forage possibilities in this area

Conclusions

The annual average yield obtained in these experiments was 1439, 4291 and 3948 kg DM/ha respectively. Mineral fertilization improved yield significantly. Eighty percent of the forage yield was obtained in the May-July period and the remaining one till September. Therefore animals are short of pastures at least six months a year.

The present stocking rate is 0.21 LU/ha, but could be increased to 0.32 LU/ha, if we consider the forage yields obtained in previous experiments and if improving pasture production is carried out.

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Mobility and feeding strategies in the pastoral systems of the Syrian *d*

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SUMMARY – The pastoral system of Syria, like most of West Asia and North Africa, is under stress with growing sheep population and continuous degradation of the rangelands. While the research and development society is strongly promoting community rangeland management in a participative and collaborative way, it is essential to characterize and assess the level of dependence the Bedouins are having today with regard to their community rangelands. Using information related to animal mobility and feeding patterns of 313 Bedouin households and their respective community characteristics, we identified 5 strategy types and in a second step explained the probability for a household to adopt one strategy over another. Results show the strong role of community characteristics in determining those choices and in particular the relationship with the cropping zone.

Keywords: Pastoral systems, animal mobility, production strategies, Syria.

***R SUM* –** "Mobilité et stratégies d'alimentation dans les systèmes pastoraux de la région de Badiah, Syrie". Le système pastoral syrien, comme la plupart des systèmes de l'Asie de l'Ouest et de l'Afrique du Nord fait face à de fortes pressions avec la croissance des effectifs ovins et la continuelle dégradation des parcours. Alors que les acteurs de la recherche et du développement promeuvent une gestion communautaire des parcours selon une approche participative et collaborative, il est essentiel de caractériser et d'estimer le niveau de dépendance que les populations Bédouines ont aujourd'hui vis-à-vis des parcours de leur site d'attache. En nous basant sur des informations relatives aux stratégies de mobilité et de régime alimentaire des troupeaux de 313 ménages Bédouins, ainsi que sur les caractéristiques de leurs communautés, nous identifions 5 types de stratégies et proposons dans un second temps d'expliquer la probabilité pour un ménage d'adopter une stratégie plutôt qu'une autre. Les résultats montrent le rôle important que jouent les caractéristiques communautaires dans la détermination des choix et en particulier la relation qu'elles entretiennent avec la zone agricole.

Mo s s: Systèmes pastoraux, mobilité animale, stratégies de production, Syrie.

The *d* system in transformation

Over the past several decades, livestock production systems in the Syrian steppe, the Badiah[1], have been the object of great transformations. This can be linked to: (i) the degradation of the steppe, (ii) the increased sheep population (tripled since 1960 reaching more than 15 millions head by the year 2000; Vercueil and Cummins, 2003), (iii) the social transformations as well as (iv) a succession of public interventions (Ngaido et al., 2001). Interventions furthering variable goals from the promotion of Bedouins settlement through the development of cultivation in the 1950-70's, the implementation of feed subsidies program and state reserves in the 1980's, to the ban of cultivation in 1992 on the rangelands located in the rainfall zone of less than 200mm. The most perceivable impact of this last measure is the increased use of supplementary feeding and the growing dependence vis-à-vis the cropping zone where flocks are sent several months per year to graze crop residues. However, we can expect that this restrictive measure did not affect the Bedouins' production strategies at the same degree. Herders belonging to communities which used to cultivate large areas should be the ones having to adapt the most in their mobility and feeding patterns.

[1] The Badiah is defined as the rangelands which receive on average of less than 200 mm of annual rainfall. The zone located in the eastern part of Syria represents 51% of the national territory.

In order to better understand the pastoral system in its complexity and assess the current rangeland management of Bedouin communities, and the production strategies of the pastoralists, a survey was conducted in spring 2005 by the International Center for Agronomic Research in Dry Areas (ICARDA) and the Ministry of Agriculture of Syria in six of the seven provinces of the Syrian Badiah[2]. The sampling method consisted in three steps: (i) twenty five "mother communities" were randomly chosen among the 125 officially censed in the steppe (ii) two communities were then randomly selected among the communities composing the mother community (iii) a sample of household was chosen to be the most representative of the community under three criteria (flock size, tribal sub group and average feed cost per ewe), which consisted of a sample of 313 households representative at the Badiah level. Multiple survey instruments consisted of: (i) a participative mapping of the community rangelands locating the main types of rangeland (ii) a vegetation characterization of each rangeland type (iii) a socio-economic survey at the community level and (iv) a household survey collecting information on livestock production and mobility strategies.

We present in this paper an up to date characterization of the Bedouin strategies with the main objective to better understand the underlying incentives for better rangeland management. Also, we are looking at Bedouin behaviour from a community angle as we are interested in better assessing the level of dependence of their flocks to the rangeland resources. After identifying the main strategies prevailing today in the Syrian Badiah, we estimate in a second step the determinants of adopting one of the strategies.

Feeding and mobility strategies

Before the introduction of hand feeding in the mid-20th century, the mobility pattern of the pastoralists was perfectly associated with the pastoral resources (forage and water) accessibility and availability. Today, animal mobility is less but still strongly associated with forage availability. In spring herders are mainly grazing on their community land. We observe some Bedouin flocks grazing on neighbouring community land, in government reserves or in other sites in the Badiah, but this practice is limited. The herders are then moving to the cropping zone at the beginning of summer to provide crop residues to their flock on rented or privately owned lands. In fall, either the flocks stay on cotton residues or go back home and are provided supplemental feed. During the 3 months of winter (December-February), the flocks diet is fully composed of concentrate and straw. The generalization of hand feeding and the apparition of trucks and mobile cisterns led to a change in the mobility pattern and grazing availability. Today some Bedouin households spend the entire year in the steppe and others in the cropping zone.

In order to tackle the issue of community range management, herders strategies vis- -vis the use of their home rangelands need to be understood. We made the hypothesis that herders in the steppe could be classified by looking at two variables: the mobility and feeding patterns. Regarding the mobility strategies, we considered a long enough period to include climatic variability between years and short enough for the information to be recalled by the interviewees. In our case, the 1999-2004 period fit these criteria with 2 bad years (1999 and 2000), three medium years (2001, 2002 and 2004) and a very good year (2003). We then looked at the frequency the herders were using the site and the number of months spent on the site. Regarding the feeding strategy, we isolated herders with a more intensive production system since this category could be considered as less dependant on the range resources. Intensification (defined in our case as the propensity for a flock to depend on hand feeding mostly concentrate feeds) is a relatively continuous process, and the segregation process is not obvious. Moreover, we separated as a group herders who supplement their flocks in spring while the rangelands are the most productive.

We identified five distinct types of mobility and feeding strategies:

(i) The opportunists come on the community site certain years only when forage is sufficiently abundant on the pasture for the community. Therefore they are the herders depending the least on community pastures. We can expect that this category is underestimated in our sample, since the year of the survey was a poor rainfall year and most of the opportunistic herders stayed in the cropping zone.

[2] Aleppo, Hama, Homs, Raqqa, Deir Ezzor and Damascus.

(ii) The regular herders use the community rangelands every year, but only for a certain period since they practice regular moves between the Badiah and the cropping zone (2 "round trip" per year on average).

(iii) The less mobiles are the herders grazing on their rangeland site every year and spending the whole year in their community at least once in the past 6 years.

(iv) The sedentary herders are the settled herders who did not move from their site, even during dry seasons and during dry years.

(v) Finally, we selected households from all these to form a fifth group called "intensive" who are the herders who used supplementary feeding in April 2004, while grazing was at its best, also this group of Bedouins does not fall in a particular mobility category described above. The discriminant variable of spring supplementation appears to be a good indicator of the most intensified production system (Table 1) which are those herders who have higher production costs and the most productive flocks. In addition, during normal rainfall years they are, with the regular herders, the ones relying the least on range grazing (approximately 20% of total forage needs from grazing rangeland).

Because the main input in this extensive production system is common property forage (community rangelands), we expect that the household strategies are interconnected among the herders of the same community. The last section of the table 2 shows in fact that the mobility categories are strongly correlated to the indicators of mobility built at the community level. We can see that the less mobile and sedentary herders belong to communities with higher household presence on average compared to the opportunists and regulars who belong to communities populated at 40% of its potential. The coefficient of variation of the population presence in the community over the past 6 years is very low (high) in communities where immobile (opportunistic) herders belong. Finally there is no apparent connection between the community mobility pattern and the intensive herders. This last category can be found in communities with the highest percentage of herders fattening their lambs .

The determinants of herders strategies in the *d*

In order to better understand the strategy of the Bedouin households, the probability for a household to fall under one of the five categories was estimated using a multinomial logit model based on the households and their community characteristics. The variables introduced in the model are the ones described below in Table 2. They are related to the household characteristics (age of the household head, household composition, human capital) responding to hypothesis based on microeconomic producer theory. We then introduced other variables referring to individual and collective endowment (absolute and relative flock size relative to the average flock size in the community, possession of water tanks) and to transaction costs (distance to markets and to water points). Three variables related to pressure are introduced (potential household density, the ability to protect community grazing from outsiders, and the density of outsiders flocks in 2004). Other variables refer to the relation with the cropping zone (as an external grazing option), and finally the percentage of community land previously cultivated is used in order to measure the impact of the ban on cultivation.

The main results of the model (Saint-Macary, 2005) are synthesized in the right hand side of Table 2. The probability to be an opportunist is higher for households owning flocks smaller than the community average, belonging to communities which have more difficulty to exclude outsiders, and are distant from the cropping zone. In addition, opportunist herders are distinguished from the less mobile and the intensive ones by owning some plots in the cropping zone. A low education rate in the family and belonging to a community located near to the cropping zone increases the probability to be a regular herder. The probability to adopt a regular mobility strategy versus a less mobile or sedentary one depends on the percentage of land that was previously cultivated. The less mobile households are distinguished from the regular and intensive households by the high external animal pressure and the low percentage of previously cultivated land in the community. The probability to fall under the sedentary category decreases and then increases with the age of the household head (the youngest and oldest are the less mobile) and increases with the presence of women in the household. Even though the descriptive statistics show the small flock holdings of this household category, the

relationship does not emerge in the model. Sedentary households have less opportunity offered in the cropping zone as they are located relatively far from the Badiah line and have less community networking in the cropping zone. Of the intensive herders, the sedentary ones have better access to water points and are settled not far from a town. The intensive households own larger flocks than the community average and belong to communities with a low potential household density.

Table 1. Five categories of herders in the Syria Badiah and the characteristics of each

	Opportunist	Regular	Less mobile	Sedentary	Intensive
Number of households	31	75	106	41	60
Mobility pattern, 1999-2004					
Total no. of months on site in past 6 years	25.4*	32.2*	51.5*	72*	42.0
Coefficient of variation in length of residence	0.51*	0.06*	0.28*	0*	0.18
No. of months on site in 1999 (low-rainfall year)	2.8*	4.3*	6.7	12*	5.1*
No. of months on site in 2004 (medium-rainfall year)	7.8	5.9*	9.8*	12*	8.9
Total no. of moves in past 6 years	4.0*	11.7*	6.3	0*	7.5
Feeding strategies, 2004					
Concentrate use (%)	46.8	33.8*	44.7	49.5*	49.8*
Crop residue use (%)	16.9*	46.8*	22.5*	18.1*	27.4
Grazing on community rangeland (%)	36.3*	19.4*	32.8*	32.4	22.8*
Productivity indicators, 2004					
Productivity index†	0.46	0.43*	0.48	0.48	0.50
Total production cost per ewe (SP) ††	2142	2155	1834	1623	2412*
Lambs fattened (%)	33	42	40	22*	54*
Community-level mobility and fattening patterns, 1999-2004					
Average herder presence ††† 1999-2004	0.40*	0.43*	0.56*	0.59*	0.53
Variation in herder presence 1999-2004 (coefficient of variation)	0.66*	0.41	0.42	0.37	0.39
Herder presence in 1999 (low-rainfall year)	0.28*	0.30*	0.40	0.49*	0.36
Herder presence in 2004 (medium-rainfall year)	0.52*	0.52*	0.68*	0.65	0.62
Residents fattening their lambs (%)	63.4	77.6	65.5	61.3	86.1*

* Significantly different from all other means at the 5% probability level.

† Indicator of productivity obtained through a factor analysis from four variables (mortality rate, lambing rate, milk production per ewe and per year, percentage of ewes that gave birth to twins).

†† SP = Syrian pound in 2005, 1US = 50 SP.

††† Indicator of use of community rangeland, calculated as (No. of households with sheep × months spent on community-rangeland site per year)/(total no. of households who use community-rangeland site × 12).

Because the structural characteristics of the community (distance of the community to the cropping zone, the nearest town or water points internal and external demographic pressure) are playing an important role in explaining the mobility and feeding strategies of the Syrian Bedouins, the adoption processes rely more on constrained choices than on deliberate ones. This study shows therefore the importance of analysing the households within their community in this particular segmented society. Households belonging to communities which used to depend on barley cultivation before the ban, continue to strongly rely today on the cropping zone resources. However, they did not move their main residency location (as the opportunists) and keep a very regular mobility pattern between the two zones.

Table 2. Descriptive statistics of explicative variables and summary of results of the estimated model

Description	Var†	Average value					Summary of estimation results††				
		Opp	Reg	LM	Imm	Int	Opp	Reg	LM	Imm	Int
Household characteristics											
Number of members in the household	H	11.1	11.2	11.6	9.5	11.1					
Age of household head	H	51.3	53.5	50.4	49.3	50.1				-/+	
% of adult woman in the household	H	0.30	0.30	0.31	0.38	0.35				+	
% of member educated	H	0.23	0.22	0.29	0.29	0.34		-			
Flock size	H	232	191	280	86	265					
Flock size relative to average flock size in the community	H	1.06	1.82	1.41	0.55	2.12	-				+
Water access											
Distance to the closest water point in km	C	9.35	8.19	3.99	6.20	3.15				- (OR)	- (OR)
Number of water tanks	H	0.52	0.49	0.64	0.15	0.47				-	
Internal and external pressure											
Potential household density in the community †††	C	0.10	0.07	0.05	0.10	0.03					-
Leader able to protect community borders+	C	0.16	0.43	0.43	0.46	0.37	-				
No. of outsiders animals grazing in the community (per ha)	C	1.95	0.70	1.26	1.92	0.61			+ (RV)		
Relation with cropping zone											
Distance to the *Badiah* line (km)	C	63.6	22.3	49.9	48.4	46.7	+	-		+	
Community has members living in the cropping zone+	C	0.39	0.27	0.13	0.05	0.22				-	
Household own cropland in the cropping zone+	H	0.13	0.05	0.04	0.05	0.05	+ (LV)				
Other variables											
% of area which was previously cropped	C	0.31	0.60	0.38	0.40	0.45		+ (LI)	- (RV)		
Distance to the closest town (km)	C	49.1	49.3	57.3	45.7	60.8				-	

+ Indicates dummy variables.

† Level of variability: H = household; C = community.

†† A + or - sign without parenthesis indicates that the regression coefficients are statistically different for at least 3 out of the 4 multilogit equations, a + or - sign followed by a parenthesis indicates in the parenthesis to which equation the estimated coefficients are statistically significant: O = opportunist, R = regular, L = less mobile, I = sedentary, V = intensive.

†††Density indicator = total community members (migrants + residents) / total area of the community (ha).

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Development of an information system for the environmental and economic management of the *dehesa/montado* ecosystem in Extremadura and Alentejo

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SUMMARY – This paper presents the first results of the project Interreg-IIIA SPA4.E13 to develop an information system for the environmental and economic management of the dehesa/montado ecosystem. The dehesa and the most important of their quality products (PDO and PGI) are described. There are two partners in the project, which coordinate the 15 research teams participating in the work. The research was planned around six activities: Coordination, Physical Factors, Biological Factors, Production systems, Social and Economic Characterisation and Geographic Information System (GIS) and Decision Support System (DSS) The most significant of the project's achievements up to the moment are: creation of extensive information of the dehesa and transfer of the project results: (i) Creation of a website and a digital library of the dehesa; and (ii) Transfer of results through conferences on the dehesa. To complete the GIS with new data obtained and finalise and test the models and the DSS, a second phase of the project has been approved by the European Union.

Keywords: Dehesa, Montado, PDO, PGI, GIS, DSS, environment, management.

***R SUM* –** "Développement d'un système d'information pour la gestion environnementale et économique de l'écosystème de dehesa/montado dans l'Extrémadure et l'Alentejo". Cet article présente les premiers résultats du projet Interreg-IIIA SPA4.E13 pour développer un système d'information pour la gestion économique et environnementale de l'écosystème dehesa/montado. On décrit la dehesa et ses principaux produits de qualité (DOP et IGP). Il y a deux organismes responsables du projet qui coordonnent 15 Équipes de Recherche. La recherche a été planifiée dans 6 activités : Coordination, Facteurs physiques, Facteurs biologiques, Systèmes de production, Caractérisation sociale et économique, et Caractérisation et Systèmes d'Information Géographique (SIG) et Systèmes d'Appui à la Décision (SAD). Les réalisations les plus significatives du projet sont : (i) Création d'une information étendue sur la dehesa ; et (ii) Transfert des résultats du projet : création d'une page Web et d'une bibliothèque numérique sur la dehesa, organisation de symposiums sur la dehesa. Une seconde phase du projet a été approuvée par l'Union Européenne pour compléter le GIS avec de nouvelles données, et finir et tester les modèles et le SAD.

Mo s s : Dehesa, Montado, DOP, IGP, GIS, SAD, environnement, gestion.

Introduction

The dehesa ecosystem (called montado in Portugal), has arisen from the Mediterranean forest where man has eliminated undergrowth. Its characteristic vegetation is the Quercus ssp. (holm oak and cork oak) together with grasses and pulses (graminea and leguminae), which form the basic feedstock for free range livestock comprised of local breeds of pigs, cattle, sheep and goats. These are very important due to the quality of the derived products.

This ecosystem, which covers an extension of more than five million hectares in the Southwest of the Iberian Peninsula, is also of great interest because of its environmental values (rich flora and fauna), landscape and leisure activities (rural tourism, hunting).

The high quality of the dehesa's animal products, derived from their special characteristics, means demand is high, despite being slightly more expensive than mass produced products. This has led to many of them being protected by quality protocols approved by the European Union, the most outstanding of which are the PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication):

(i) Iberian cured ham products such as: PDO "Dehesa de Extremadura", PGI "Jamón de Guijuelo" (Salamanca), PDO "Jamón de Huelva", PDO "Carne de Porco Alentejano", PDO "Presunto de Barrancos", PGI "Presunto e Paleta de Campo Maior e Elvas", PDO" Presunto e Paleta do Alentejo".

(ii) Beef products such as: PGI "Ternera de Extremadura", PGI "Carne de Avila", PGI "Morucha de Salamanca" and "Carne de Retinta de Extremadura y Andaluc a" (PGI pending). The last three comprise the "Vacuno Extensivo de Calidad" Federation. In the Portuguese montados we find the following: PDO "Carnalentejana", PDO "Carne Mertolenga" and PDO "Carne de Charneca", which are included in the provisional TSG (Traditional Speciality Guaranteed) known as "Carne de Bovino Tradicional".

(iii) In lamb and mutton products we have: PGI "Carne de Merina", PGI "Cordero de Extremadura (CORDERE) ", and in Alentejo there is lamb PGI "Borrego do Nordeste Alentejano", "Borrego do Montemor-O-Novo" and "Borrego do Baixo Alentejo".

(iv) With regard to high quality cheese we find the PDO " ueso de la Serena" and PDO "Torta del Casar" (made with sheep's milk), PDO " ueso de los Ibores" (made with goat milk), and in the Portuguese montados the PDOs " ueijo Serpa", " ueijo de vora", " ueijo de Nisa" y " ueijo de Castelo Branco" are produced.

(v) Honey is also a high quality product obtained in the dehesas. The PDO "Miel Villuercas-Ibores" and the PDO "Mel do Alentejo" have been recognised.

(vi) Organic products, appreciated for their nutritional and health qualities as well as their optimum organoleptic properties, for which there is a growing demand can also be produced in the dehesas, where free range farming systems predominate.

Summarising, the importance of the dehesa/montado ecosystem in the Alentejo and Extremadura regions is fundamental in the social, economic and environmental areas. The vulnerability of this ecosystem has led to efforts to guarantee its preservation and to monitor it at local and regional levels. It has also led to the development of systems for supporting decision making in the sustainable use of the ecosystem. To this end, an R+D project is being carried out, which is included in the initiative INTERREG IIIA, a programme of the EU (Mart n Bellido et al., 2000). This paper presents the first results.

The *e es Mo do* pro ect

The objective of the Interreg-IIIA project SPA4.E13: "Development of an information system for the environmental and economic management of the dehesa/montado ecosystem in Extremadura and Alentejo" is to create models and technology to resolve the problems encountered by that the agents involved in the management of the dehesa/montado.

Project objectives

The final objective is to develop an integral model for the monitoring, management, conservation and sustainable development of the dehesa ecosystem.

The specific objectives of this project are:

(i) Complete a diagnostic of the physical environment in which the dehesa is established.

(ii) Characterise the ecosystem in terms of its biological factors.

(iii) Determine and evaluate the productive system's vulnerability factors.

(iv) Create a model for managing this ecosystem that permits its conservation and sustainable development.

(v) Develop information systems to support the decision-making process, based on strategies for sustaining this ecosystem. Develop technology on which to base policies for the use of natural resources on a regional scale.

Methodology

An innovative methodology has been adopted for this project, based on its multi-disciplinary character. This methodology allows us to relate physical, biological, social and economic variables, using the new technologies of the information society.

The research was planned around six activities, with the following purposes:

(i) Coordination: Global project management in financial, technical and scientific terms, and the transfer of the results obtained.

(ii) Physical Factors: Creation of a digital database and maps of physical factors and determination of the state of deterioration of the dehesas.

(iii) Biological Factors: Characterisation of the bio-diversity of the dehesa, determination of bio-indicators, and creation of the corresponding cartographic maps.

(iv) Productive Systems: Determination of the quantity and quality of grazing pastures in the dehesas. Characterisation and regional mapping of the livestock and hunting production systems. Taking of an inventory of and mapping the dehesas' forests and classifying them according to age.

(v) Social and Economic Characterisation: Characterisation of the dehesa ecosystem from a social and economic point of view, evaluating the profitability and sustainability of the system, determining the effect of the different institutional support policies on the dehesa systems, and the definition of the final model for efficient management.

(vi) Geographic Information System and Decision-making Support System: Centralisation and processing of the available geographic information, definition and use of cartographic criteria, development of the Geographic Information System (GIS), creation of social/economic and regional strategic decision-making models and the dehesa Decision-making Support System (SAD).

To carry out the work, data has been collected from existing published sources in different institutions: official Statistic Services, regional agricultural, animal husbandry, forestry and environmental services, national meteorological services and land conservation and regional planning Institutions of both countries.

On the other hand, 85 farms are cooperating in the study. These are situated in all the areas where data referring to each of the objectives is being collected (Espejo D az et al., 2006a) (Fig. 1).

Fig. 1. Farms studied in Alentejo (Portugal) and Extremadura (Spain).

Also, remote sensing parameters like NDVI (Normalized Difference Vegetation Index) or ST (Surface Temperature), have been calculated from information of the resource satellites images on the areas being studied in the project. In this way we can relate variables collected in the fieldwork with those from the satellite to build predictive models. In the Alentejo region an inventory of natural resources was taken on 650 pieces of land to develop predictive models, particularly in relation to cork production.

Research teams

There are two partners in this project, one in Extremadura and the other in Alentejo, which coordinate the 15 research teams participating in the work, included in these Centres.

The Regional Ministry of Infrastructure and Technological Development of Junta de Extremadura, coordinates the work of the following Institutions:

(i) Agricultural Research Centre of La Orden and Valdesequera.

(ii) Regional Agriculture and Environment Ministry: Animal and Vegetable Health Services and the Forestry, Hunting and Fishing Service.

(iii) University of Extremadura: Areas of Physical and Human Geography of the Geography and Regional Planning Department, School of Agricultural Engineering and the Veterinary Faculty.

The following bodies cooperate with the Alentejo Regional Agriculture Directorate:

(i) University of vora: Research and Advanced Management Training Centre and the Macro-ecological and Conservation unit.

(ii) New University of Lisbon: Geography and Regional Planning Research Centre, Faculty of Social and Human Sciences.

(iii) Superior Institute of Agriculture: Forestry Engineering Department.

(iv) Portuguese National Agricultural Research Institute: National Plant Improvement Station of Elvas.

(v) University of Algarve: Engineering and Natural Resources Faculty.

Results

The most important results of the project are (Mart n Bellido et al., 2004):

Creation of extensive information on the dehesa

(i) Physical Factors:

- Maps at an individual farm level (climate, hydrology, altitude, slope of the land, geomorphology, etc.).
- Identification of areas environmentally sensitive to soil deterioration.
- Characterisation of soil quality and state of deterioration.

(ii) Biological factors and environmental conservation:

- Identification of the diversity of flora and fauna in the pilot farms.
- Listing of the vegetal diversity in the dehesa.
- Spatial distribution models for plants and birds in Alentejo using the databases of UNIBA.

- identification of insect diversity in 18 pilot farms in Alentejo.
- Studies of the physiology of the cork tree and the detection of Phytophtora spp. in Alentejo.

(iii) Characterisation of production systems:

- Characterisation of agricultural, grazing land, livestock, hunting and forestry production systems.
- Data collection in the pilot farms regarding the production, composition and quality of grazing.
- Inventory of forestry resources in Alentejo based on 650 pieces of land.

(iv) Social/economic characterisation:

- Social/economic Inventory of the pilot farms. Social/economic characterisation of Alentejo.
- Microeconomic analysis and study of the profitability of farms in the dehesa.
- Development of economic models of different scenarios.

(v) Information system and generation of GIS applications and decision-making support applications (DSS):

- Methodology about selection of 85 cooperating farms in the two regions.
- Average monthly vegetation index and the average thermal index for the whole of Extremadura, based on satellite information (NOAA-AVHRRR) (Fig. 2).
- Mapping of land use in Extremadura based on images from the Landsat ETM+ satellite.
- Conception of the Geographical Information System (GIS).
- Programming of interfaces for the introduction of all the information collected in the project.
- Introduction of information in the GIS.

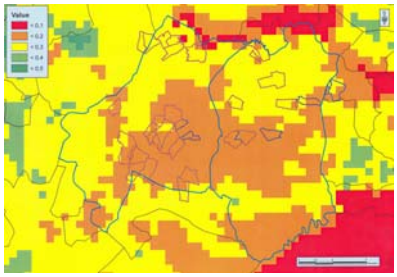

Fig. 2. La Serena NDVI, June 2003.

Transfer of the project results

(i) Creation of a Web page. A webpage has been created: http://dehesa.juntaextremadura.net. In it we have brought together information on legislation, news of the dehesa, flora and fauna, environment, breeds, the variety of quality poducts whose origins are in the agricultural production systems associated with the dehesa, etc.

(ii) Set up a digital library on the dehesa. To disseminate and promote this ecosystem in its many functions.Through the same Web page access can be had to the digital library, which contains complete publications on the dehesa, (currently there are more than 300 publications). These can be consulted by the public and authors who wish can add their articles on the theme (see Junta de Extremadura, 2005).

(iii) Transfer of results through conferences on the Dehesa. During the project, various activities were held to disseminate the results (Pomarinho, Fregenal, Beja). The most important was the Conference on the Management of the Montados and Dehesas of the Iberian Peninsula recently held at the Finca La Orden (General Directorate of Research, Technological Development and Innovation). The provisional results of the project have been published in the Proceedings of the conference (Espejo D az et al., 2006b).

Future plan

In order to complete the GIS with new data obtained and finalise and test the models and the SAD, an application to the European Union for a second phase of the project has been approved. The scheme of Activities and Teams described for the first project is considered valid for the second one.

The principal results anticipated at the close of this project are:

(i) Characterisation of the whole region in agricultural, social, economic and environmental terms relating to the state of the dehesa, in order to recommend measures and actions that will contribute to its sustainability.

(ii) Identification of areas with different states of deterioration at a regional level, as well as areas in danger of becoming desert and their cartographic representation for Regional Planning purposes.

(iii) Construction of an Information Management System for Alentejo and Extremadura, which provides ongoing regional information on the variables studied as an input to the Decision Support System (SAD).

(iv) Development of management support models for the dehesa/montado and the writing of software for applying the models.

In conclusion, this project seeks to offer the institutions the capacity to acquire information and implement actions in reforming the common agriculture policy that have an impact on the production systems of the dehesa.

Acknowledgements

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Recent evolution of suckler cow farming systems in the Spanish central Pyrenees

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SUMMARY – The evolution of suckler cow farming systems in Spanish mountain areas was studied (1989/91-2004). Results showed important structural adjustments (physical and economic size), change of productive orientation, extensification of grazing management, reduction of variable cost and large increase of labour productivity due to the impact of subsidies on economic indicators.

Keywords: Farm evolution, economics, suckler cow, mountain areas.

RESUME – *" volution récente des systèmes d élevage de bovines allaitants dans les Pyrénées Centrales espagnoles". On analyse les évolutions des systèmes bovins en one de montagne (1989/91 2004). Les résultats montrent une considérable adaptation structurelle des exploitations, un changement de l'orientation productive et une gestion technique plus extensive. Les résultats économiques ont fortement augmenté, mais en ce qui concerne la contribution des soutiens directs aux exploitations.*

Mots-clés : *volution des exploitations, économie, bovin allaitant, montagne.*

Introduction

Mountain areas in Europe have great relevance in environmental and social terms, holding great ecological, landscape and cultural diversity. Grazing livestock systems play a central role in the conservation on these areas and agricultural policies currently recognise their multiple functions, productive, environmental and societal, because of their contribution to economic and social cohesion and rural development (Laurent *et al*., 2003). However, there are a number of factors that threaten the continuity of agricultural households in Spanish mountain areas, specially those of smaller dimension (Baldock *et al*., 1996), and therefore the sustainability of large pastoral ecosystems is compromised (Bernués *et al.*, 2005). The abandonment of farming activities has being a continuous process in many European areas, with diverse environmental consequences. In most cases a clear evidence of negative impacts of this abandonment has been described (McDonalds *et al*., 2000).

In general terms, the changes observed in extensive farming systems in the last few years can be interpreted as attempts to adapt to the changing socio-economic environment, predominantly influenced by agricultural policies, but local and farm-specific characteristics are also very important.

Within this context, the aim of this study was to analyse the evolution of suckler cow farming systems in mountain areas in the last 15 years. Current structural, management, economic and productivity variables were compared with those observed in 1990.

Material and methods

Data were collected through a direct questionnaire applied to farmers in 3 valleys of the Spainsh Central Spanish Pyrenees in 2004 (Broto, Baliera-Barrabés and Benasque). The survey gathered information on farm structure, family composition and labour, management and economic

[1]The study was performed within the project INIA RTA03-029 FEDER. The first author want to acknowledge the support of CONACYT-Mexico, Fundación Carolina-Spain and the Universidad Autónoma del Estado de México.

performance. The sample was designed according to previous studies in the same areas (Olaizola, 1991 Bernués, 1994), so that the information would be available in the same farms in two different dates. From the initial sample of 102 farms (years 1989 and 1991), 30 disappeared in this time interval, so the final size of the sample in 2004 was 72 farms. Representative variables were analysed with a Student's T test to compare differences between dates.

Results and discussion

In relation to the abandonment of farming activities (29.4% of the initial sample), the main causes were retirement of farmers (40%) and substitution with other economic activities (56.6%), from which the most important one was tourism (33.3%). Abandonment was more pronounced in Benasque Valley (36.4% of farms) (Table 1).

Table 1. Evolution of structure, productive orientation and management (1989/1991-2004)

	Broto			Baliera-Barrabés			Benasque			Total		
	1991	2004		1991	2004		1989	2004		89-91	2004	
No. farms	32	22		37	29		33	21		102	72	
LA (ha)	17.7	34.8	***	120.9	106.2	***	26.6	43.5	***	58.1	66.1	NS
%grazing area	95.6	98.1	NS	85.8	91.2	NS	97.8	99.9	***	92.8	95.8	NS
%forage crops/ grazing a.	2.5	0	*	17.1	6.9	***	4.3	0.6	***	8.4	2.9	***
LU	46.7	69.1	***	66.8	82.6	NS	31.3	54.0	***	49.0	70.1	***
WU	1.5	1.4	NS	2.0	1.6	***	1.7	1.1	***	1.8	1.4	***
LU/ WU	31.7	52.7	***	32.4	51.4	***	17.2	49.9	***	27.3	51.4	***
%LU cattle/ LU total	92.9	94.5	*	80.1	95.8	***	85.3	100.0	***	85.6	96.6	***
% dairy farms	87.5	0.0	***	89.2	0.0	***	93.9	4.8	***	90.2	1.4	***
% fattening farms	12.5	45.5	***	10.8	55.2	***	6.1	42.9	***	9.8	48.6	***
grazing period (d)	266	302	***	249	284	***	232	323	***	249	301.1	***
%LU in mountain past.	66.8	77.0	***	50.0	72.0	***	57.3	74.4	***	57.6	74.2	***
concentrates (kg/LU/year)	418	141	***	219	49	***	638	33	***	417	73	***

NS: no significant *p < 0.5 **p < 0.01 ***p<0.001. LA: land area LU: Livestock unit WU: Working unit.

Evolution of structure, productive orientation and management

Land area (LA) increased notably en Broto and Benasque valleys in the period of study (97% and 64%, respectively), but decreased slightly in Baliera-Barrabés valley, where farms were initially bigger changes in grazing management can also explain this reduction in size (see below). Grazing areas, which already were predominant in 1990, have increased even more in percentage of LA, therefore agricultural crops are negligible. Natural pastures constituted most grazing areas, as forage crops in the global sample decreased from 8.4% to 2.9% of the total grazing area. Similarly, herd size increased markedly in all areas, but less in Baliera-Barrabés that initially had more livestock units (LU) (Table 1).

All households had a familiar character with null or very little salaried labour. Labour input (WU) decreased notably in all areas, specially in Baliera-Barrabés and Benasque (22% and 35%, respectively). Together with the observed herd size enlargement, this reduction constitutes a structural improvement of farms in these mountain areas: the proportion LU/ WU increased by 24 LU in the global sample.

Orientation of production suffered a drastic change in this period. Milk and weaned calves were the main products of cattle farming systems in the Central Pyrenees in 1990 (Olaizola *et al*., 1995). These mixed beef-dairy farms, which constituted around 90% of the initial sample, have completely disappeared. The importance of sheep and goat decreased, so we can consider the beef farming

systems as fully specialized. At the same time, many farmers expanded their production cycle to produce young bulls and heifers (10-12 months old). On-farm fattening activities, either individually or in cooperative way, currently take place in nearly 50% of the farms. Similar evolution patterns were observed in other Spanish mountain areas (Serrano *et al*., 2002). These processes respond mainly to changes of the CAP, such as the milk abandonment programmes in the nineties and the slaughter and male premiums established after the Agenda 2000 reform.

Management also changed significantly in the period of study. One of the main factors of change was the duration of the grazing season, that increased in all areas, specially in Benasque (Fig. 1) generally speaking winter housing has decreased from 3 to 2 months in average. In Baliera-Barrabés the use of mountain (summer) pastures increased more than in other areas, and rented pastures (part of farm LA), used mainly in spring and autumn, decreased slightly. The proportion of animals that use mountain pastures increased in all areas up to 75% of total LU. Also, as consequence or change of orientation and extensification of grazing management, external inputs decreased in importance. The use of off-farm concentrates to feed suckler cows dropped by 344 kg/cow/year in average, whereas this fall has been proportionally larger in Baliera-Barrabés and Benasque.

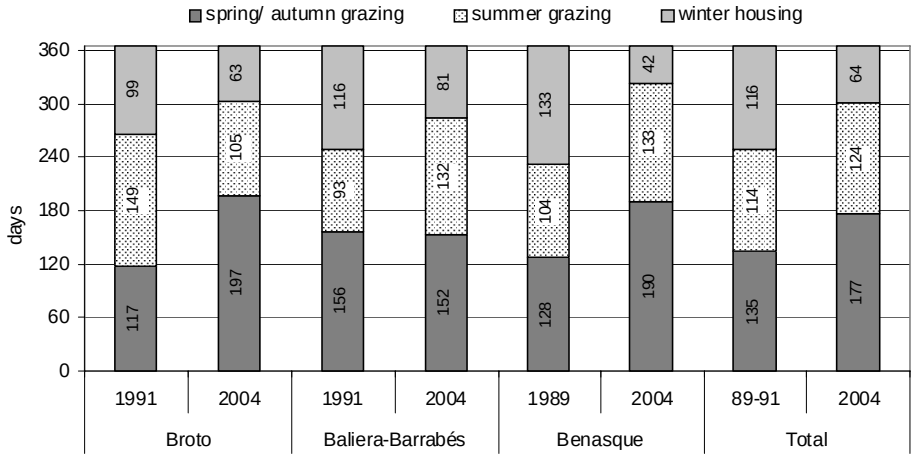

Fig. 1. Duration of the grazing seasons and the winter housing (1989/1991-2004).

Evolution of costs, economic results and productivity

Average Variable Costs (VC) increased due to the bigger size of farms (Table 2). Nevertheless, when expressed on a per-head basis, this indicator decreased, except in Baliera-Barrabés that faced an increase of VC/LU. In agreement with what was described above, feeding costs diminished in all areas. This was specially the case when only the costs assigned to suckler cows (excluding fattening feedstuffs) were considered (from 194 to 35 /cow/year). Total feeding cost decreased to a less degree in Baliera-Barrabés because of the higher importance of fattening activities in this valley.

In relation to the structure of VC, off-farm feedstuffs continued to be the largest component, although in declining relative importance (around 60%), whereas sanitary costs increased very significantly in all areas (16%). When sanitary costs were calculated per LU, significant differences were found in all areas between dates, but while in Broto and Baliera-Barrabés this cost increased, in Benasque decreased.

As could be expected, average economic size increased (Table 3) and was partially related to the physical size (land and herd) of the farms. Both Total Output (livestock products sold) and Total Revenues (Total Output + subsidies + incomes from pension fattening[2]) increased, although differences were not significant for the first indicator that did not include subsidies. In a similar way,

[2] Fattening of calves that are owned by other farmers at a certain price. Only facilities and labour are accounted as costs.

Gross Margin (GM= Total Revenues – Variable Costs) increased significantly in the 3 areas: around 90% in Broto, 73% in Baliera-Barrabés and only 40% in Benasque. However, when subsidies were removed from the GM, no significant differences were found in Broto (small increase) and Baliera-Barrabés (small reduction), and a significant reduction was observed in Benasque valley. Subsidies clearly played a central role in the economic performance of the farms and in the differences observed between dates, as they represented 61% of GM in 2004 and only 17% in 1991 (Fig. 2).

Table 2. Evolution of unitary costs and structure of costs (1989/1991-2004)

	Broto			Baliera-Barrabés			Benasque			Total		
	1991	2004		1991	2004		1989	2004		89-91	2004	
Variable Costs (000)	11.9	20.7	*	19.3	28.4	*	11.6	15.8	NS	14.5	22.3	***
Variable Costs/ LU	234	226	NS	276	362	**	362	231	***	291	281	NS
Total feeding costs/ LU	170	130	**	181	158	NS	258	135	***	202	142	***
Suckler cow f.c./ LU	167	46	***	173	29	***	243	30	***	194	35	***
Sanitary costs/ LU	27	33	***	30	37	***	37	25	***	31	32	NS
% feeding costs/ VC	67.4	60.5	*	60.1	57.5	NS	69.4	60.1	*	65.4	59.2	***
% sanitary costs/ VC	12.4	18.3	***	10.8	14.9	***	10.5	15.7	***	11.2	16.2	***

NS = no significant *p < 0.5 **p < 0.01 ***p < 0.001. Figures in constant monetary value 2004 ( ).

Table 3. Evolution of economic results and productivity (1989/1991-2004)

	Broto			Baliera-Barrabés			Benasque			Total		
	1991	2004		1991	2004		1991	2004		89-91	2004	
Total Output (sales) †	35.6	44.9	NS	46.2	49.0	NS	32.1	29.5	NS	38.3	41.9	NS
Total Revenue†	39.8	73.8	***	54.4	89.2	***	35.0	48.7	**	43.5	72.5	***
Gross Margin (GM) †	27.9	53.1	***	35.1	60.8	***	23.4	32.8	**	29.1	50.1	***
GM – subsidies†	23.6	24.2	NS	26.9	24.3	NS	20.5	13.6	***	23.8	21.1	NS
%subsidies/ GM	14.8	59.2	***	22.5	64.2	***	13.5	59.1	***	17.1	61.1	***
Total Revenue/ LU	853	913	NS	817	1093	***	1121	866	***	927	970	NS
GM/ LU	619	687	**	541	731	***	759	635	***	636	689	**
GM – subsidies/ LU	533	299	***	437	290	***	667	285	***	541	291	***
GM/ WU[1]	18.5	38.6	***	17.7	40.4	***	13.3	30.6	***	16.5	36.9	***
GM – subsidies/ WU†	15.6	17.1	NS	13.8	16.1	NS	11.7	12.6	NS	13.7	15.4	NS

NS: no significant *p < 0.5 **p < 0.01 ***p < 0.001. Figures in constant monetary value 2004 ( ).
† (000).

Herd productivity (Total revenue/ LU and GM/ LU) increased in Broto and in particular in Baliera-Barrabés, but again Benasque showed an inverse behaviour as herd productivity decreased significantly (Fig. 3a). In 2004, for the total sample, the GM obtained per LU was very similar to the figure obtained by Veysset *et al*. (2005) in the Massif Central in France. Nevertheless, when subsidies were removed from the calculation, animal productivity decreased 46% in average for all areas (ranging from 33.6% in Baliera-Barrabés to 57.3% in Benasque).

Labour productivity (GM/ WU) improved substantially in all areas (123.6% in average) due to the increase in GM and the reduction of on-farm labour (Fig. 3b). Nevertheless, if calculated without subsidies, labour productivity only increased slightly, although differences between 1990 and 2004 were not significant in any valley or in the general sample.

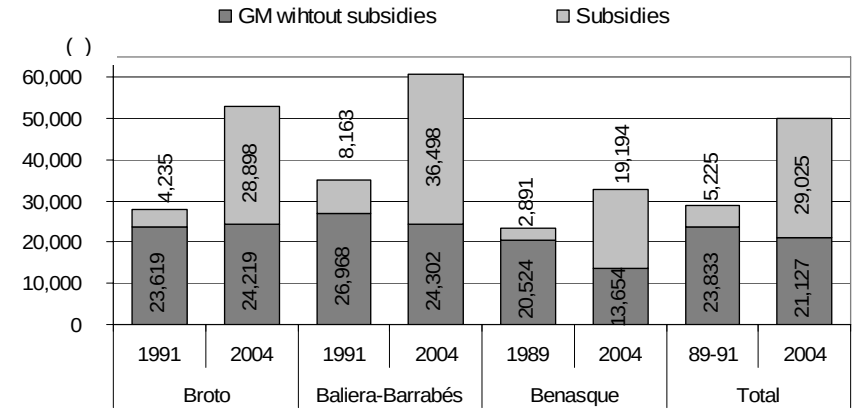

Fig. 2. Gross Margin composition and evolution (1989/1991-2004).

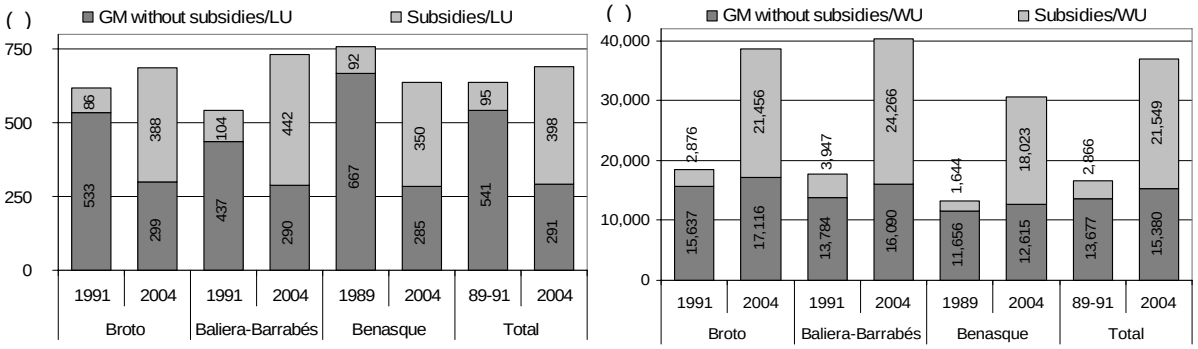

Fig. 3. Evolution of animal (a) and labour (b) productivity (1989/1991-2004).

To conclude, we can affirm that results showed a clear process of structural adjustment towards suckler cow farming systems in the areas of study, although there were differences between valleys. Also, a drastic change of productive orientation was observed: total abandonment of dairy and expansion towards fattening in a large proportion of farms. Those changes were directly influenced by specific measures and successive reforms of the CAP (milk abandonment programmes, 1992 reform and Agenda 2000). Also, a process of extensification was observed in management, with significant enlargement of grazing periods and utilization of mountain pastures, and in economics terms, as utilization of off-farm inputs decreased notably, especially feedstuffs. Extensification meant a reduction of unitary Variable Costs and also of animal productivity (without considering subsidies), although there was a process of capital intensification (higher ratio LU/WU). Labour productivity, which constitutes one of the central factors for the sustainability of these livestock systems (Veysset *et al.*, 2005) increased slightly in the period of study, but due to the great importance of subsidies the economic viability of the production system can be guaranteed.

In the future, we will deepen the analysis of relationships between internal farm factors, family and farmer objectives, socio-economic factors and the different adaptation strategies followed.

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The sustainability of the "dehesas"

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SUMMARY – An analysis of the productive systems used in "dehesa" grazing lands confirms that the highest quality products come from Iberian pigs that have been fed on acorns. Furthermore, this productive system also offers the best prospects for sustainability. However, there are currently two factors that could condition this situation in the relatively short term: on the one hand, the deterioration of oak trees as the result of oak decline ("seca") and an absence of natural regeneration caused by intensive systems; and on the other hand, market competition with Iberian pork produced using intensive farming methods. Faced with these challenges there are several possible courses of action, mainly focusing on oak reforestation and the establishment of classification and traceability methods that ensure clear differentiation of products on the market. This paper deals with our efforts to create georeferenced records for oak trees using GIS tools, which include compositional and nutritional information about the acorns produced. Our research into quality differentiation systems for Iberian pig carcasses and pork products using NIRS technology is also discussed. This paper considers the viability of the various courses of action and the feasibility of simultaneously considering environmental and cultural alternatives.

Keywords: Oak trees, acorns, composition, GIS, Iberian pork, quality, NIRS.

R SUM **–** "La durabilité des dehesas". L'analyse des systèmes productifs qui se pratiquent dans les forêts de chênes verts et de chênes-liège ("dehesa") donne comme résultat que la production du porc ibérique nourri aux glands est celle qui présente la plus grande singularité et, à la fois, celle qui a de meilleures perspectives de durabilité. Cependant, il existe actuellement deux facteurs qui peuvent conditionner cette situation à pas très long terme: d'une part, la détérioration qui se produit sans cesse dans les forêts de chênes verts en conséquence du phénomène de dessèchage (seca) et du manque de rejets, dérivé de l'intensification réalisée dans les systèmes productifs. D'autre part, la concurrence dans le marché subie par le porc ibérique des forêts de chênes verts, face à celui qui provient de systèmes d'élevage intensif. Devant ces défis, plusieurs mesures sont considérées, centrées sur la reforestation contrôlée des chênaies et sur l'établissement de méthodes de typification et de traçabilité qui assurent nettement la différenciation des produits sur le marché. Cette communication présente les travaux de recherche que l'on réalise visant à dresser l'inventaire de chênes verts et de chênes-liège géographiquement référencé, et avec l'information bromatologique et nutritionnelle de leurs glands, associé à un SIG, ainsi que ceux qui se rapportent à l'établissement de systèmes de différenciation de la qualité en carcasse et des produits dérivés du porc ibérique, centrés sur l'utilisation de la technologie NIRS.

La viabilité des différentes mesures et la pertinence de prendre en considération simultanément des alternatives complémentaires de type environnemental et culturel sont ici soumises à réflexion.

Mo s s : Chênaie, glands, composition, SIG, porc ibérique, qualité, NIRS.

Introduction

"Dehesa" ecosystems are currently suffering deterioration and decline, which represents a significant loss of our heritage. Navarro and Fernández (2000) analysed the phenomenon of oak decline ("seca") and classified the various different factors responsible into the following groups: predisposition factors (pruning, ploughing, grazing), which would weaken the trees, lead to a lack of regeneration or age the trees; detonating factors, which are mainly related to water shortages and high temperatures; catalyst factors, which are dependent on the tree's genetics and soil conditions; and executing agents, including various different diseases (Phytophthora, Hypoxilon, Diplodia, etc.) and pests (Cerambyx, Coroebus, etc.).

There are two potentially complementary ways of tackling this loss of forest land. By reducing livestock grazing and the ploughing of lands, the holm oaks would naturally regenerate. However, this is a very slow method and it could prove somewhat ineffective, bearing in mind that productive systems will always tend to intensify. The other option would involve regeneration by sowing or planting new trees that, if they were sufficiently protected and supported, would lead to faster regeneration (fast being a relative term, considering the characteristics of this species).

Leaving aside the inherent problems of how natural forest land could be turned into a kind of plantation, we should also consider the material needed to put it into practice and the selection criteria to be used. In addition to resistance to certain diseases, the criteria to be considered should include production levels and the nutritional composition of the acorns produced.

Another issue to bear in mind is changing market demand for pork from acorn-fed pigs. The quality of these products is widely known and accepted however, traditional productive systems have been modified and the use of compound feed has given rise to new products that aim to imitate the characteristics of pork from Iberian pigs fed on fallen acorns and fodder ("*montanera"*). This has led to changes being introduced in product controls, but the productive systems have responded by making further adjustments so that their products continue to mimic "*montanera"* pork. All of this has given rise to a loss of differential value and consumers are willing to pay for products that are not clearly differentiated.

The following sections explain the work our group has been doing to analyse and value information about compositional and nutritional variations in acorns, as well as our research into quality controls in the Iberian pork industry. Finally, we consider the effect that current circumstances might have on grazing land productive ecosystems.

Compositional inventory of acorns in the edroches alley C rdoba

Through our various different studies (Fern ndez *et al*., 2004, 2005 Moreno *et al.*, 2005), we have examined the influence of several factors, such as the ripeness of the acorns, the soil and climate of the area as well as the combined effect of factors linked to the year of production on compositional and nutritional variations of the acorns produced in the Pedroches Valley (Cordoba). We have also examined the possible influence of the area of production on the differential quality obtained in Iberian pigs fed in each of these areas. Beyond the specific data, which can be analysed in these publications, of greater interest are the conclusions we have been able to draw.

There is a great deal of variation in the compositional characteristics of acorns from the same area (Table 1). Furthermore, the differences observed between different areas cannot be the sole justification for the differences in the quality of the pork, which must be affected more by handling conditions.

Table 1. Mean values of the compositional parameters of acorn pulp in the Pedroches Valley (Cordoba) (Fern ndez *et al*., 2005)

Parameters	Mean	Minimum	Maximum
DM (%)	56.00	44.61	60.94
CP (% DM)	5.87	3.62	10.50
EE (% DM)	8.79	4.03	13.10
Starch (% DM)	61.88	54.78	69.77
Sugar (% DM)	4.71	2.04	9.96
Gross energy (kcal/kg DM)	4705	4080	5052
Palmitic acid (%)	15.65	12.00	19.30
Stearic acid (%)	2.77	1.80	4.90
Oleic acid (%)	63.55	53.30	70.60
Linoleic acid (%)	15.83	10.80	21.80

Owing to the heterogeneity between the oak trees in any one geographical area and the lack of identification of morphological factors that could be linked to this diversity and which could be used to differentiate the quality of the acorns without the need for previous analysis (correlations between size of the acorns and their fat, protein, starch and oleic acid content, as the most significant components, do not explain more than 10% of variability), it is crucial to establish techniques that could perform these analyses quickly and economically, if we aim to explore the greatest possible number of oak

trees. In this respect, of particular interest is our research into calibration equations for said parameters using NIRS (Near Infrared Spectroscopy) techniques. Table 2 shows the provisional results of this research.

Table 2. NIRS calibration statistics obtained for the various different analytical parameters (Fernández et al., 2005)

Parameters†	Mean	Range	SD	No.	SECV	R^2	RPD	RER
Protein	5,79	3,62-7,96	0,869	150	0,223	0,934	3,89	19,46
Fat	8,90	13,10-4,12	1,560	154	0,308	0,961	5,06	29,15
Oleic acid	63,77	54,40-70,60	2,435	164	1,204	0,762	2,02	13,45
Linoleic acid	15,72	10,80-20,70	1,902	164	0,728	0,856	2,61	13,59

† SD: standard deviation; No.: number of samples; SECV: standard error of cross validation; R^2: coefficient of multiple determination; RPD: ratio of the SD of the reference data to the SECV; RER: ratio of the range between the reference data to the SECV.

Finally, in order to keep records of the geographical location of the trees analysed, we linked the information obtained to a GIS survey carried out for the area. This georeferenced database is shown in Fig. 1 and could be linked in with additional information about resistance to disease, which is currently being studied by a forestry engineering group that we are working with.

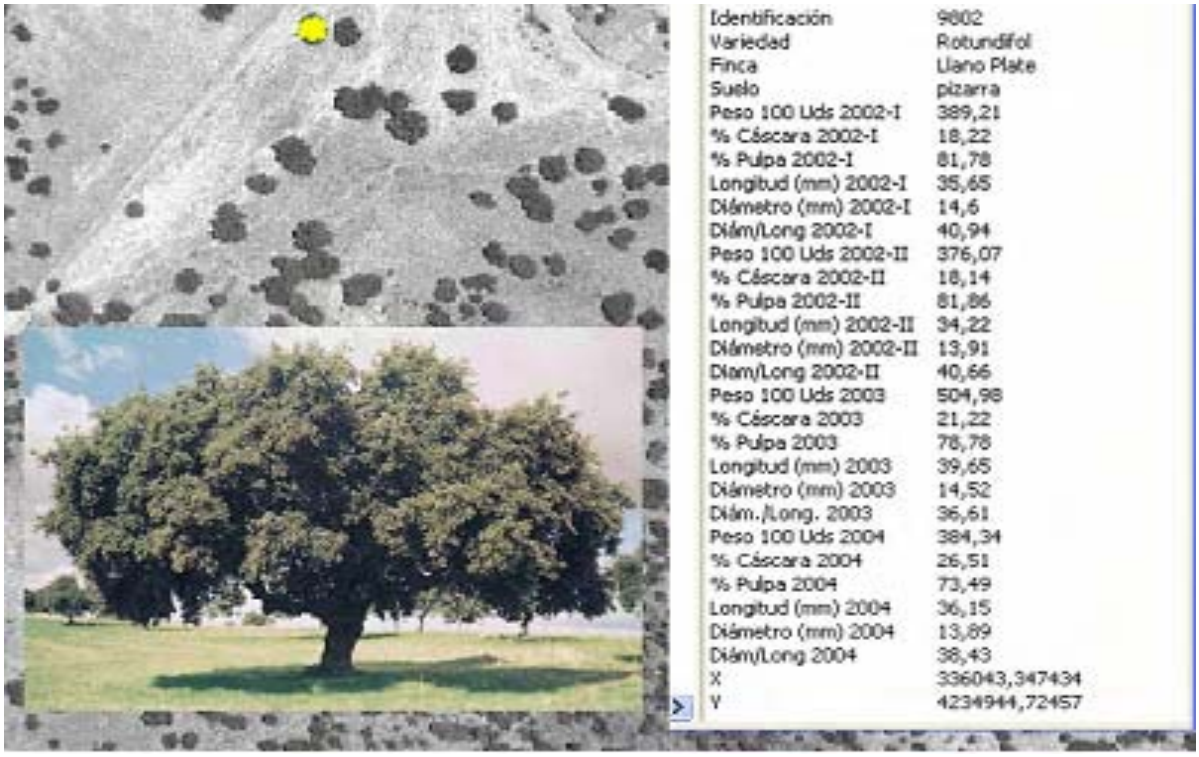

Fig. 1. Associated information of one oak tree analysed.

Quality control systems for Iberian pork

Several different methodologies have been proposed to assess pigs' feeding regimes. The simplest of these proposals involves carrying out periodic field controls during the animals' fattening stage. However, these controls present a high degree of subjectivity and hence tend to be unreliable.

The first analysis methods used were based on the determination of slip temperature (fusion) or iodine levels in the pig's subcutaneous fat. Both methodologies assess the level of unsaturated fatty acids in the subcutaneous fat. Despite the contribution of these analysis techniques, they were eventually abandoned because it was too easy to modify both the slip temperature and iodine levels, by adding polyunsaturated fats to the animals' diet.

In the 1990s, various different analytical techniques were used to assess the feeding regime of Iberian pigs (García Olmo, 2002), including:

(i) Determination of the fatty acid content in the animals' subcutaneous, hepatic and intramuscular fat or the non saponifiable fraction (chiefly in phospholipids) using gas chromatography.

(ii) Determination of the triglyceride content using high resolution liquid chromatography.

(iii) Determination of aldehydes in the fat using gas chromatography.

(iv) Determination of the isotope ratio $^{13}C/^{12}C$ or $^{15}N/^{14}N$ using radioactive isotopes.

(v) Detection of volatile compounds in fat and cured products using mass spectrometry or electronic nose technology.

(vi) Determination of the content of antioxidant compounds (chiefly α-tocopherol) in muscle tissue using liquid chromatography.

All the studies carried our using these methods produced excellent results, with a high success rate classifying batches of animals into "bellota" (fattening only with acorn and grass), "recebo" (fattening with acorn, grass and same feed compound) "cebo" (fattening only with feed compound) quality categories.

Of all the analysis methodologies, the most commonly used by the industry to assess feeding regimes is the determination of fatty acids in subcutaneous fat. This analysis technique was introduced by MAPA (Spanish Ministry of Agriculture and Food) in around the mid-1990s and the Official Sales Contract (OSC) determined that this criterion should be used along with field controls in order to asses the feeding regimes of Iberian pigs to be slaughtered. The OSC indicated maximum and/or minimum levels for the most common fatty acids present in pig fat (palmitic, stearic, oleic and linoleic acid), which must be detected in order for the product to be classified in a specific commercial category.

The application of these levels made a great contribution in this area when the Official Sales Contract was first implemented. However, nowadays, this classification criterion is the object of continual criticism, both by industrialists and livestock farmers.

As a replacement for the classification method based on composition levels, the use of quality indexes has been proposed, based on the complete fatty acid profile of the pig's subcutaneous fat, using multivariate statistical analysis tools. The efficiency of these quality indexes has been demonstrated and validated by ten years of research carried out with the industry. Differences between the results obtained by the quality indexes and observations in field controls are minimal.

However, there are several limitations when it comes to implementing fatty acid determination using gas chromatography in the industry itself. The analyses take a long time and the cost per sample is high. Furthermore, specialised staff is required to use the analytical instruments, which makes it impossible to carry out a complete analysis of all the animals in a batch. Hence, a single representative sample is obtained from a batch of pigs and analysed by public or private laboratories.

This difficulty could be avoided using Near Infrared Spectroscopy (NIRS). García Olmo (2002) described this methodology using the different forms of sample presentation: either as melted fat or as subcutaneous adipose tissue. In both cases, the analytical capacity of this technique outperforms gas chromatography, as demonstrated by the values shown in Table 3, which includes data obtained by 15 laboratories using gas chromatography and by our own facilities using NIRS.

Table 3. Comparison of fatty acid values in Iberian pork fat obtained via gas chromatography (CG) or by NIRS

Method	C16:0	C18:0	C18:1	C18:2
CG range (15 laboratories)	21.0-22.6	9.5-10.8	50.8-52.3	9.3-10.4
CG mean	21.5	9.9	51.8	9.7
NIRS (1 laboratory)	21.8	9.9	51.6	9.6

Furthermore, spectral information and discriminant analysis techniques have been proven to be highly efficient in the differentiation of feeding regimes in the final fattening stage in fresh loin Iberian pork samples.

Final considerations

Is it worth trying to improve productivity in oak forests? It is worth supporting a clearly differentiated product in the market, produced by traditional grazing methods? Is it possible to share this commitment if current indiscriminate "*Recebo*" categories are maintained, narrowing the gap between traditionally produced pork products and those produced by farmers who do not have grazing land but who have invested in dietary studies so that their products can compete with traditional Iberian "*montanera*" pork? In order to do this, objective product controls would have to be implemented that were very different from the current systems of field observations and analytic control of certain fatty acids which, although possible to achieve using NIRS, would require a significant research effort.

In any case, the need to regenerate grazing land should not only be considered in terms of producing a quality product, or even just as a way of improving the agricultural productive system, but rather it should be considered in terms of all of its attributes: productive, environmental and cultural. In our opinion, it is worth trying to maintain a balanced ecosystem, even though it remains unclear how future sustainability could be supported economically. Further work needs to be done in this area, since the future is not predetermined, but rather constructed from the present.

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Trends in the transformation of livestock systems in Lithuania

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SUMMARY – Agriculture in Lithuania performs a significant social, ethno-cultural and environmental function. More than half of the country's territory is used for agricultural activities. There are favourable conditions to develop dairy and meat farming, cultivate cereals and other crops. The transition from a central planning economy to a market economy has been very complicated and hard. A very high decrease in animal production has been recorded. The study presents an analytic overview of the economic and social aspects of agricultural and livestock farming development. The diversity of farming systems, factors influencing farm diversity are described in the study. The evaluation of the changes and current trends and prospects of development of agriculture are presented in the study.

Keywords: Production, trends, diversity, farming systems.

R SUM – "Tendances de transformation des systèmes d'élevage en Lituanie". En Lituanie l'agriculture joue un grand rôle sur le plan économique, social et environnemental. Plus de la moitié du territoire du pays est utilisée pour l'activité agricole. Les conditions sont favorables pour le développement de la production de viande et de lait, de céréales et d'autres cultures. Le passage d'une économie planifiée centralisée à l'économie de marché a été compliqué et difficile. L'ampleur de la production des produits d'élevage a diminué sensiblement. Dans l'aperçu on analyse les aspects économiques et sociaux du développement de l'élevage, la diversité des systèmes d'exploitations et les facteurs qui influencent cette diversité. On analyse aussi les changements et les perspectives du développement de l'élevage.

Mo s s : Production, tendances, diversité, systèmes d'exploitations.

Introduction

Agriculture in Lithuania performs a very important economic, social, environmental and ethno-cultural role. Due to geopolitical and historic circumstances, the economic and social importance of the agricultural sector in Lithuania is still higher than in the neighbouring countries.

Soil in Lithuania is mostly of average productivity, similar to that in other countries of this region – Poland, Denmark, southern Scandinavia (ALDP, 2004). However, in respect of the duration of the vegetative season and average temperatures our country has less favourable conditions. Although compared to the conditions of its northern neighbours, Lithuania is in a relatively better situation.

Natural conditions in Lithuania are suitable for the development of dairy and meat farming, growing of cereals, flax, potatoes, sugar beet, rape, fruit and vegetables, developing organic farming.

The transition from the central planning economy to market economy demanded radical political decisions, which, regrettably, have not always been economically sound or socially acceptable (SSDTLA, 2002). During the last fifteen years, the agricultural policies of Lithuania were not very stable. Political views and positions on the land reform and the development of individual agricultural industries kept changing.

The aim of this study was to present a survey of the situation in Lithuanian agriculture, conditions, diversity of farming systems and prospects of animal production development in Lithuania.

The place of agriculture in national economy

The years 2003-2005 were distinguished for a rapid growth of the results in all economic sectors. The Gross Domestic Product (GPD) change per year reached 9 percent when recounted in constant

prices (Agriculture of Lithuania, 2004). A significant share of Lithuanian GPD is created in the agricultural and food sector.

National agriculture is capable of producing sufficient supplies of the main food products for domestic consumption (Fig. 1). Agriculture is closely integrated in the Lithuanian economic and social life. The living standards and well-being of the total population are highly dependent on the quality and prices of food products. On the other hand, the purchasing power of the population determines the demand for agricultural and food products, the economic viability and income of the agricultural sector.

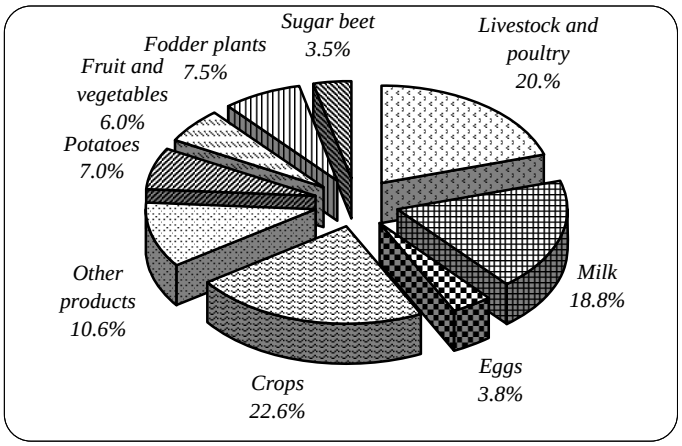

Fig. 1. Structure of gross agricultural production in 2004 (Lietuvos statistikos metra tis, 2004).

With the restructuring of the national economy, the importance of agriculture for the national economy is gradually diminishing (ALDP, 2004), which causes the reduction of labour force engaged in agriculture and of the share the agricultural sector has in the gross value added. In addition to its economic and social functions, the countryside performs important environmental and ethnocultural functions.

Land

Lithuania s territory covers an area of 6.53 million hectares. The total agricultural purpose land area occupies 3.96 million hectares. Agricultural purpose land accounts for 63.4 per cent of the total land area of the country, and 85.4 per cent of total land used for agricultural activities. The data of land use by land categories is presented in Fig. 2.

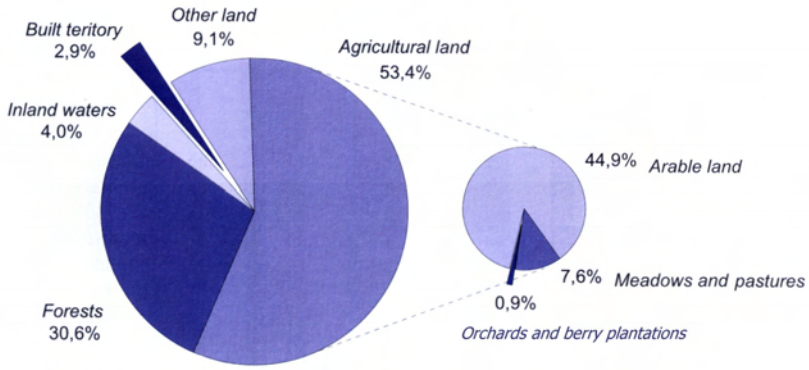

Fig. 2. Total land area by land categories (SYSLCRE, 2003).

The fertility of utilised agricultural land is usually dominated by land quality points, which show the quality of farmland by crop productivity under average economic conditions for farming. The best lands are concentrated in Central Lithuania. The composition of soil in Lithuania is far from uniform. Thirteen per cent of the agricultural land is sand over 37 per cent is sandy loam, over 39 per cent of clay loam, 3 per cent of clay, about 8 per cent of peat The greater part of the Lithuanian territory is lowlands separated by low hills.

Farm structure

Today, three types of farms can be found in Lithuania: farmers farms, agricultural companies and individual family farms (Table 1). The number of farmers farms increased by 64 percent over the last year (from 39,249 farms on the 1st of January 2003, to 53,944 active farms on the 1st of February 2004) agricultural companies work in a stable and promising tendency, only 6 of them stopped functioning last year the number of individual farms decreased by 16 percent.

Table1. Farm structure

	Number of farms	Land use (thousand ha)	Average farm size (ha)
Farmers farms	53,944	1354.6	25.1
Agricultural companies and enterprises	610	321.4	526.9
Individual (family) farms	217,557	1159.8	5.3
Total	272,111	2835.8	10.4

About 84 per cent of all the farmers' farms possess an area smaller than 10 hectares. In more productive land areas, such farms account for about 64 per cent. In less productive land areas, farms of 20-50 ha account for 8 per cent, while in higher quality land areas they account for 16 per cent. Farms exceeding 50 ha account for 5 per cent in more favourable areas, while in less favourable areas they account for as little as 0.6 per cent (ALDP, 2004).

The structural changes of farms are greatly influenced by their economic position and possibilities to invest. The analysis of the data in the financial accounting of farmers shows that the economic position of a farm depends also on its size. Small family farms (households) do not usually have many livestock, but the number of animals is highly dependent on the fertility of the land. Larger family farms in fertile regions keep 1.6-2 times more animals than farms of the same size do in areas less favourable for farming.

Situation in milk sector

From the economic point of view, the milk sector is identified as a branch of agriculture with a comparative advantage. Milk production made up 21.5 per cent of the total value of agricultural production. In the Strategy for Agricultural in Lithuania, the dairy sector acknowledged as a priority branch of agriculture.

Changes in milk production have been caused by the period of transition from a planned to market economy. In 2003, if compared with 1990, the number of cows and milk production has decreased almost by half. In 2004, milk production was by 5% higher in comparison with 2002 and by 30% higher in comparison with 1999 The number of milk recorded cows increased by one third or 33 percent as compared with the previous period. On February 1, 2005, there were controlled more than 180 thousand milk-recorded cows, i.e. 40 percent of all cows bred in the country (ARAR, 2006).

Although small dairy farms still take a dominant position in Lithuania, there is a tendency towards their consolidation (SSDTLA, 2002). In 1999 herd size was on average 2.0 milking cows, 2.3 in 2003 , and 2.5 in 2005. 77.9 per cent of farms keep 1-2 cows, 20.5 per cent – 3-9 cows and only 1.6 per cent of the total number of farms keep 10 and more cows (Table 2).

Table 2. Groups of dairy farms by number of cows in 1999-2004

Groups by number of cows	1999		2004		2004 compared to 1999 (%)	
	Number of farms	Number of cows (thousand)	Number of farms	Number of cows (thousand)	Number of farms	Number of cows (thousand)
1-2	193,893	263.4	149,822	199.6	77	76
3-9	37,816	141.9	39,443	162.3	104	114
10-19	631	7.6	2204	27.8	349	366
20-29	103	2.3	339	7.9	329	343
50-99	90	6.5	119	7.8	132	120
100≤	213	50.3	134	38.2	63	76
Total	232,814	474.4	192,259	450.8	83	98

Two major cattle breeds kept in Lithuania are Lithuanian Black-and-White and Lithuanian Red Cattle accounting for 66% and 30% respectively of all cattle. Imported cattle of German, Dutch, Danish, Swedish, Finish and Lithuanian ancient breeds Ash-grey and White-Backed cattle account for the remaining 4% of the total dairy cattle population.

It may be foreseen that milk production will remain the priority branch of animal husbandry (LTEDSL, 2002). The efficiency of branch development will be based on farm modernization, improvement of feeding as well as breeding and production traits of livestock.

Situation and prospects of meat sector

Meat production is one of the underlying agricultural branches in the country. In 2003, this sector made up 20 percent of gross agricultural produce value. Following several year decline in meat production (PAP, 2005), last year a substantial increase was reached in the country. The major parts of meat production come from pork (42.7%), cattle (38%) and poultry (19.2%). The procurement of other animals, including sheep, goats, rabbits and horses, increased as much as twice, the overall buying in gross quantity was small. Although, pork and its products is of particular demand in national market, after joint the EU the increase of beef production begin. In these latter years, a growth in the number of beef and crossbreed cattle has been noticed.

Despite the high rate of decrease of livestock number in 1990-2000, since 2001 we can see inconsiderable increase in livestock number (Gyvulių skaičius, 2004) (Fig. 3).

Two kinds of livestock traditionally prevail in the herd of Lithuania – cattle and pigs. Milk production is a prevailing trend in Lithuania. Cattle of dairy breeds are less suitable for meat production, unfortunately, beef cattle and mixed breeds do not reach 5 per cent of the total number of cattle in Lithuania. At the end of 2005, there were only 0.3 per cent pure beef cattle and 6.1 per cent crossbreeds. Comparatively small livestock breeding farms constitute the majority. The classification farms by cattle number show that as many as 98 per cent of the farmers kept 1-9 heads of cattle and only 2 per cent keep more than 10 heads of cattle (Lietuvos statistikos metra tis, 2004). One farm had on the average 2.7 heads of cattle. Meanwhile, the predominant type of cattle raising in Lithuania is extensive pasturing no industrial cattle raising for meat is practised.

Pig-breeding farms are not so small. In 2004, the average number of pigs on the farms was 5.8 heads. Forty five per cent of the farms had more than 1000, but at the same time, forty per cent of the farms had less than 10 pigs. In Lithuania, pigs, the hybrids of the Lithuanian White with other breeds, are bred in the majority of pig production units and on farmers' farms. The number of pigs slaughtered for meat – Swedish, Danish Yorkshire, Pietrain, Norwegian, Danish Landrace, Duroc breeds – constitute 12-14 per cent of the total number of slaughtered pigs.

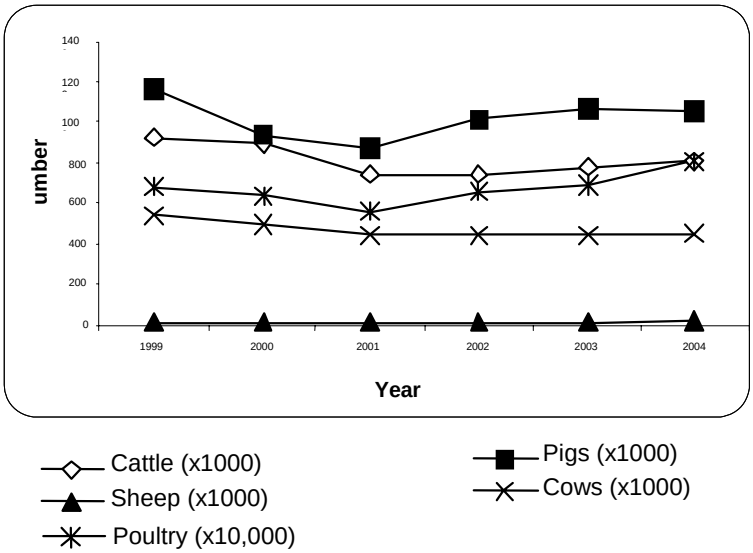

Fig. 3. Dynamics of the number of livestock and poultry.

In 2004, 31 thousand sheep were bred in 5.0 thousand farms. The number of goats was considerably larger than that of sheep. It is planned to expand mutton and goat meat production in those regions where it is not expedient to develop other agricultural activities.

Last year, the procurement of poultry increased by 30 per cent (Agriculture of Lithuania, 2004). About 90 per cent of poultry is produced in six national poultry-yards, the main specialization of which is broiler breeding. Broilers, geese, ducks, turkeys and, lately, ostriches are bred on the farms. The domestic market is being supplied with 80 per cent of the poultry bred in the country.

The main trends in meat production: (i) enlargement, modernization and specialization of farms (ii) improvement of animal feeding and (iii) improvement of breeding and carcass qualities of animals, development of commercial crossbreeding by using the best animals of foreign breeds.

Conclusions

The agricultural sector produces a significant share of the Lithuanian gross domestic product. Though the number of livestock and output of animal production was decreased animal husbandry still remains one of main branches of agriculture that gives the high income.

Dairy cattle production is and will remain the dominant branch of agriculture in Lithuania. Its efficiency increase should be based on improvement of feeding as well as breeding and production traits of Lithuanian cattle. Beef cattle production should become more substantial in meat production.

Pig production competitiveness should be based on breeding and carcass qualities of Lithuanian pigs, development of commercial crossbreeding by using the best animals of foreign breeds.

Supplementary branches of animal husbandry as sheep, goat, horse, and poultry breeding should be developed not only to satisfy the demands of home market but also for the export production.

The future of the market belongs to the modern, progressive agriculture based on the newest know-how technologies.

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La valorisation des productions bovines biologiques catalanes

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RESUME – Les productions bovines biologiques constituent l'orientation la plus importante pour l'Agriculture Biologique en Catalogne. L'étude de la valorisation des productions bovines biologiques a été réalisée dans le but de déterminer si celles-ci sont viables et durables en termes économiques. La marge brute moyenne des exploitations bovines biologiques (lait et viande), obtenue à partir d'enquêtes, a été comparée avec celle d'exploitations conventionnelles. Les principaux résultats montrent que le maintien de l'aide à l'élevage biologique est nécessaire pour que les exploitations biologiques puissent être compétitives par rapport aux exploitations conventionnelles en attendant, d'une part, un développement du marché de la viande biologique espéré et d'autre part, une amélioration des résultats techniques des producteurs de lait biologique catalans.

Mots-clés : Agriculture biologique, Catalogne, productions bovines, subvention, durable.

SUMMARY – *"Valori ation of organic beef products from Catalonia". Organic cattle production constitutes the most important activity of Organic Agriculture in Catalonia. he study of the valori ation of Catalan organic production as conducted in order to determine if they ere sustainable in the long term in economic terms. he average gross margin of organic farms (meat and milk producers), obtained through a survey, as compared to the gross margin of conventional farms. he main results sho that subsidies for organic cattle production must be maintained to allo organic farms to be competitive ith conventional farms, and to develop the organic meat market and improve the technical results of Catalan organic milk producers.*

Key words: *Organic agriculture, Catalonia, cattle production, subsidy, sustainable.*

Introduction

La réforme de la Politique Agricole Commune (PAC) 2003 a mis l'accent sur la viabilité environnementale, économique et sociale long terme du secteur agricole. L'agriculture biologique répond largement aux objectifs actuels de la PAC, ce qui est clairement spécifié dans le Règlement (CE) 1257/1999 et le Plan d'action européen en matière d'alimentation et d'agriculture biologiques (CE, 2004). Dans ces deux documents, est mis en évidence le r le de l'agriculture biologique dans la politique de développement rural durable, c'est- -dire dans le second pilier de la PAC.

La mise en place de l'aide l'élevage biologique (aide la conversion l'élevage biologique en principe, calculée en fonction des surfaces en p tures et en prés biologiques par exploitation) entre 2001 et 2002 a permis le développement des productions bovines biologiques en Catalogne. Cela a été le cas notamment pour la production de viande bovine biologique en zone de montagne, qui représentait 1/3 du total de la surface agricole biologique catalane et la moitié des élevages biologiques catalans en 2004. Les productions bovines biologiques ont de nombreux effets positifs en termes de durabilité environnementale (pratique d'un p turage en extensif - protection des sols et maintien des paysages) et sociale (maintien de population rurale en zone défavorisée). Cependant, on ne peut considérer le mode de production biologique comme "durable" s'il ne permet pas la viabilité économique des exploitations biologiques, c'est- -dire si celles-ci ne peuvent être compétitives avec les exploitations conventionnelles du point de vue des résultats économiques.

Généralement, la rentabilité des exploitations biologiques est conditionnée d'une part, par un prix des intrants biologiques plus élevé et par une plus faible productivité et d'autre part, par un prix de vente du produit biologique plus élevé qu'en mode de production conventionnel. En ce qui concerne la rentabilité des producteurs de viande, les différentes études réalisées montrent que les aliments

achetés co tent plus cher en biologique (Legendre, 2002 Laignel et Beno t, 2004) et que le co t des contr les réalisés par l'organisme certificateur représente un facteur de co t additionnel (Mata *et al*., 2003). En revanche, les frais de vétérinaires et les frais divers d'élevage sont similaires en biologique et en conventionnel (Laignel et Beno t, 2004). En ce qui concerne les exploitations orientées bovins lait, les études empiriques ont démontré la viabilité économique du système biologique malgré de moindres rendements par vache laitière (Stonehouse *et al*., 2001 Butler, 2002 Pérez et Alvarez, 2003). Toutefois, il semble que seuls les systèmes de production extensifs sortent gagnants de la conversion au mode de production biologique (Berentsen *et al*., 1998).

Le principal objectif de la présente étude est de réaliser une analyse économique de la rentabilité des productions de viande bovine et de lait de vache biologique catalanes, et de comparer les résultats avec ceux obtenus en exploitations conventionnelles.

M thodologie

Les données ont été obtenues partir d'enquêtes auprès de producteurs et de professionnels du secteur bovin biologique en Catalogne. L'analyse économique est basée sur l'évaluation de la marge brute 2004 des exploitations biologiques.

(i) Obtention des données sur la production de viande bovine biologique:
- Zone de Production: Nord de la Province de Lleida (81% des exploitations biologiques).
- Echantillon "veaux de 6-7 mois" : 5 exploitations (3,5% des éleveurs biologiques catalans).
- Echantillon "veaux de 10-12 mois" : 12 exploitations (55% des éleveurs-engraisseurs biologiques catalans).

(ii) Obtention des données sur la production de lait de vache biologique:
- Zone de production : Provinces de Girona (2 exploitations) et de Tarragona (1 exploitation).
- Echantillon "production de lait" : 3 exploitations (100% des producteurs).

La marge brute (Produits – Charges opérationnelles) des exploitations biologiques a été calculée partir des données obtenues lors des enquêtes en considérant :

(i) Dans le cas des producteurs de viande :
- Produits: Les ventes de veaux et les aides per ues.
- Charges opérationnelles: Les charges d'alimentation et le co t du contr le de certification Agriculture Biologique (on considère que les autres postes sont similaires en biologique et en conventionnel).

(ii) Dans le cas des producteurs de lait :
- Produits: Les ventes de lait, les variations d'inventaires, l'autoconsommation, les réformes des vaches laitières, les ventes de veaux et les aides per ues.
- Charges opérationnelles: Les charges d'alimentation, les frais vétérinaires et le co t du contr le de certification Agriculture Biologique.

En ce qui concerne les producteurs de viande, l'indisponibilité de publications récentes sur la marge brute des exploitations conventionnelles nous a conduit évaluer leurs résultats économiques partir d'un modèle basé sur une exploitation type de 50 vaches allaitantes (moyenne 2004 des effectifs de vaches allaitantes des exploitations biologiques de la Province de Lleida information personnel du CCPAE Consell Catal de la Producció Agraria Ecol gica , 2005) ayant des caractéristiques semblables celles des exploitations biologiques visitées (chargement moyen de 0,9 UGB par hectare de Surface Fourragère Principale et 0,73 veaux vivants en moyenne par vache allaitante et par an). La comparaison entre marge brute en biologique et en conventionnel a été réalisée partir de ce modèle. On a considéré, d'une part, les résultats techniques ainsi que les prix de vente et les prix des intrants des exploitations biologiques visitées. D'autre part, on a évalué la marge brute de l'exploitation conventionnelle type partir des données recueillies auprès des gérants et de 3 producteurs conventionnels de l'Identification Géographique Protégée (IGP) "Ternera de los Pirineos Catalanes" IGP sous laquelle la majorité des producteurs conventionnels du Nord de la Province de Lleida commercialisent leur production.

Dans le cas des producteurs de lait biologique, les résultats ont été comparés ceux d'un groupe d'exploitations conventionnelles (Maynegre, *et al*., 2005). Il s'agit d'un groupe de 27 exploitations intensives ayant une importante production annuelle (de l'ordre de 800 000 litres de lait contre 300 000 litres en moyenne en Catalogne Gutiérrez, 2003).

R sultats et discussion

La marge brute des exploitations biologiques est 54% supérieure celle des exploitations conventionnelles malgré des charges opérationnelles plus élevées (Table 1), aussi bien en élevage (veaux de 6-7 mois) qu'en élevage-engraissement (veaux de 10-12 mois). Les éleveurs biologiques (veaux de 6-7 mois) ne parviennent pas vendre les veaux un prix de vente plus élevé que celui des veaux conventionnels (2,79 /kg de poids vif). Toutefois, les aides qu'ils re oivent leur permettent d'obtenir une meilleure rentabilité.

Les éleveurs-engraisseurs biologiques vendent, en moyenne, 54% de leur production sous la dénomination Agriculture Biologique un prix plus élevé qu'en conventionnel (4,27 /kg en biologique contre 3 /kg de carcasse en conventionnel). De plus, gr ce l'aide l'élevage biologique, ils touchent davantage de subventions qu'en conventionnel. Ainsi, les éleveurs-engraisseurs biologiques obtiennent de meilleurs résultats, avec un total des produits plus élevé (+57%) leur permettant de compenser des charges opérationnelles plus importantes qu'en conventionnel (+60%) et d'avoir une meilleure rentabilité.

Table 1. Produits, charges opérationnelles et marge brute en élevage de veaux de 6-7 mois et en élevage de veaux de 10-12 mois, en 2004

	Elevage de veaux (6-7 mois)		Elevage de veaux (10-12 mois)	
	Biologique	Conventionnel	Biologique	Conventionnel
Effectif (vaches allaitantes)	50	50	50	50
Surface fourragère principale (ha)	84,5	84,5	84,5	84,5
Produits ( )				
Ventes de veaux	17 334	17 334	25 020	20 250
Aides PAC	10 000	10 000	14 860	14 860
Aide l'élevage biologique	15 235	-	15 235	-
Total produits ( )	42 569	27 334	55 115	35 110
Charges opérationnelles ( )				
Alimentation	2190	1391	10 943	6804
Concentrés	-	-	8753	5413
Paille + minéraux	2190	1391	2190	1391
Contr le agriculture biologique	300	-	300	-
Total charges opérationnelles ( )	2490	1391	11 243	6804
Marge brute ( )	40 079	25 943	43 872	28 306

Globalement, on observe une meilleure rentabilité du système biologique pour la production de viande bovine mais en réalité, celle-ci repose essentiellement sur l'aide l'élevage biologique. En effet, la différence entre marge brute en biologique et marge brute en conventionnel est entièrement due cette aide pour les éleveurs. En ce qui concerne les éleveurs-engraisseurs, sans l'aide l'élevage biologique, il est nécessaire de commercialiser au minimum 52% de la production sous la dénomination Agriculture Biologique pour compenser des co ts plus élevés qu'en conventionnel et obtenir la même marge brute. En moyenne, avec 54% des veaux vendus sous cette dénomination, les éleveurs-engraisseurs parviennent dépasser ce seuil. Cependant, selon les exploitations, le pourcentage de vente sous la dénomination Agriculture Biologique varie de 0 100%. Ainsi, pour certains éleveurs-engraisseurs, l'aide l'élevage biologique est indispensable pour garantir une meilleure marge brute qu'en conventionnel.

On constate (Table 2) qu'en système conventionnel intensif (4,9 vache laitière/ha en conventionnel contre 0,7 vache laitière/ha en biologique), l'activité laitière est mieux rentabilisée qu'en système biologique. Cela s'explique principalement par un effectif de vaches laitières plus important et une meilleure productivité en conventionnel. Si l'on suppose que les exploitations biologiques ont les mêmes charges de structure par litre de lait produit qu'en conventionnel, on observe que la marge nette moyenne par exploitation (marge brute – charges de structure) est près de 3 fois plus élevée en système conventionnel. Les différences observées sur les résultats économiques s'accroissent lorsque l'on rapporte la marge brute la main d' uvre moyenne par exploitation: la marge brute moyenne par UTA est de 16756 en biologique contre 57332 en conventionnel.

En revanche, les producteurs biologiques bénéficient d'un meilleur prix de vente du lait et d'un niveau d'aide par litre de lait produit plus élevé qu'en conventionnel. Par conséquent, bien qu'en conventionnel les dépenses alimentaires soient mieux raisonnées par rapport aux résultats techniques des vaches laitières (production en litres/vache laitière/an), la production laitière est mieux valorisée en biologique et la marge brute par vache laitière des exploitations biologiques est 57% supérieure celle de l'échantillon d'exploitations conventionnelles.

Table 2. Produits, charges opérationnelles et marge brute en production de lait de vache, en 2004

	Elevage biologique			Elevage conventionnel†		
Unité de travail agricole (UTA)	1,5			2,26		
Effectif (vaches laitières)	14			100		
Surface fourragère (ha)	20,5			20,4		
Production (l/vache laitière/an)	3444			8492		
uota (l)	45 000			744 591		
Total production (l)	46 814			842 952		
Prix de vente (/l)	0,600			0,314		
Produits	Total ( )	(/l)	(/vache)	Total ( )	(/l)	(/vache)
Laits-autres produits animaux	28 115	0,600	2177	266 466	0,316	2665
Ventes	27 768	0,590	2137	261 998	0,311	2620
Autoconsommation	460	0,012	44	4299	0,005	43
Variation d'inventaire	-113	-0,002	-4	169	0,000	2
Produits viande	1374	0,030	100	12 644	0,015	126
Réformes	216	0,006	19	4552	0,005	45
Veaux < 1 mois	1158	0,024	81	8092	0,010	81
Aides PAC	3349	0,067	236	17 702	0,021	177
Aide l'élevage biologique	3596	0,074	239	-	-	-
Total produits	36 433	0,771	475	296 812	0,352	2968
Charges opérationnelles :						
Alimentation	10 394	0,212	637	148 444	0,176	1484
Fourrages	10 372	0,211	636			
Minéraux	23	0,000	2			
Frais de vétérinaire	605	0,014	48	18 798	0,022	188
Contr le AB	300	0,008	28	-	-	-
Total charges opérationnelles	11 300	0,234	714	167 242	0,198	1672
Marge brute	25 134	0,537	2038	129 570	0,154	1296
Charges de structure				65 835	0,078	658
Marge nette				63 735	0,076	638

†Résultats obtenus par Maynegre *et al.* (2005).

Conclusion

Conformément aux principes généraux de l'économie de marché, la majoration de prix pour les produits biologiques ne peut se maintenir que si la demande se développe. Actuellement, en Catalogne, ce problème se traduit par des ventes de veaux biologiques en conventionnel alors que les producteurs doivent faire face des charges plus importantes qu'en conventionnel.

La remise en cause du soutien l'élevage biologique pourrait occasionner l'abandon du mode de production biologique pour les producteurs ne parvenant pas compenser le surco t des aliments biologiques par la vente des veaux sous la dénomination Agriculture Biologique. En attendant le développement du marché et l'approximation de sa taille (en Espagne notamment), il est donc nécessaire de maintenir l'aide l'élevage biologique pour laisser le temps aux producteurs et aux transformateurs de développer leurs relations commerciales et d'établir de nouveaux canaux de commercialisation.

Compte tenu des différences importantes de capacité de production laitière entre exploitations biologiques et conventionnelles (quota lait et rendement moyen par vache laitière), même soutenues au titre de l'élevage biologique, les exploitations biologiques ont une marge brute inférieure celle réalisée en mode de production conventionnel. Toutefois, bénéficiant d'un meilleur prix de vente du lait, elles peuvent parvenir une rentabilité équivalente la moyenne des exploitations conventionnelles. Avec un faible rendement laitier par vache et par an en biologique (3444 l) contre 6749 l en conventionnel en Catalogne (Gutiérrez, 2003) et un mode de production semi-extensif, elles nécessitent un plus grand nombre de vaches laitières par exploitation et une surface fourragère principale plus de 3 fois plus grande qu'en conventionnel pour parvenir une marge brute similaire celle de l'exploitation catalane conventionnelle moyenne (quota de l'ordre de 300 000 l de lait).

En conclusion, le maintien du soutien l'élevage biologique est nécessaire pour permettre la compétitivité des exploitations biologiques avec les exploitations conventionnelles, du point de vue économique. L'aide actuelle devrait être remplacée par une aide spécifique calculée en fonction des contraintes économiques que posent la commercialisation et les co ts de production de la viande de veau biologique. En production laitière, cette aide spécifique devrait tenir compte des différences de productivité et des besoins en surface fourragère entre modes de production biologique et conventionnel. D'autre part, le maintien du soutien l'élevage biologique peut se justifier par le fait que les exploitations biologiques utilisent des méthodes de production fournissant des services d'ordre environnementaux au-del du niveau de référence des bonnes pratiques agricoles, liées la politique de développement durable et au second pilier de la PAC. Ces services ne doivent donc pas être seulement financés par le consommateur mais par l'ensemble de la société.

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Perspective of sustainable Piemontese cattle rearing in the north-west of Italy

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SUMMARY – To verify the prospects of sustainable livestock development of Piemontese cattle in their distribution areas, a survey was conducted with local farmers. Despite the reduction in the number of animals, the Piemontese breed is reared in extensive and traditional systems, as well as in marginal areas, because of the revenues farmers can obtain from the typical and high quality products. In the mentioned areas animals are normally fed on pasture and some producers complain about soil fertility losses due to the breed frugality that influences the amount of excreta, even if the breed hardiness confers animals a high adaptability to poor environments. In conclusion, Piemontese cattle rearing in the breed distribution areas is important to promote the territory and landscape maintenance and to avoid environmental imbalances. Political and financial measures recognising the additional market functions of such livestock systems could stimulate the local economy.

Keywords: Livestock functions, multifunctional activity, marginal areas, local breed.

RESUME – "Perspectives de l'élevage durable d'animaux Piemontese dans le nord-ouest de l'Italie". Pour vérifier les perspectives de développement soutenable de l'élevage de bétail Piemontese dans les zones traditionnelles de diffusion de la race, a été menée une enquête auprès des éleveurs locaux. Malgré une réduction du nombre de bétail, la race est encore élevée en systèmes extensifs et traditionnels, même dans les zones marginales, en raison du bon revenu obtenu par les produits typiques et de haute qualité. Dans ces zones les animaux sont normalement alimentés au pâturage, et quelques producteurs déplorent des pertes de fertilité du sol dues à la frugalité de la race qui influence la quantité d'excréta, mais à leur rusticité les animaux doivent une adaptabilité élevée aux environnements pauvres. Donc, la présence de l'élevage du bétail Piemontese dans la zone de diffusion de la race est importante pour promouvoir l'entretien territorial et du paysage et pour éviter un déséquilibre environnemental. Des mesures financières et politiques, en stimulant les fonctions agricoles extra-économiques de tels systèmes d'élevage, pourraient stimuler l'économie locale.

Mots-clés : Fonctions zootechniques, activité multifonctionnelle, zones marginales, races locales.

Introduction

Livestock develop several environmental functions and services, both positive (territorial maintenance, rural employment, food security, etc.) and negative (environmental pollution, erosion, landscape changing, system entropy growth, etc.) (Biagini and Lazzaroni, 2001). Generally the firsts prevail in non-intensive rearing systems and the lasts in intensive ones (Aimone and Biagini, 1999), and the public opinion is interested to stimulate the less intensive rearing systems, more respectful of animal welfare and guarantying a more healthy production. It appears clearly that sustainable productive processes are often linked to the livestock multifunctional role.

In the North-West of Italy (Piemonte region) an important multifunctional role is developed by the Piemontese cattle breed rearing, especially for marginal areas subject to environmental risk. In fact, in spite of a reduction in the number of such animals and farms –with a decrease in the last twenty years approximately of 35% in the cows and 50 % in the total cattle number, these lasts reared in about 15,000 farms (APA Cuneo, 2005)–, the breed is still spread in hilly or mountain areas, where begin to be evident the effects of the agriculture abandonment. In such areas, where is important the maintenance of sustainability of the agricultural and livestock production systems, the Piemontese cattle are reared in extensive and traditional systems for the good income obtained by typical and high quality products (meat and cheese), very appreciated by the market.

To evaluate the sustainability of the Piemontese cattle rearing and its future developing perspective in the breed traditional diffusion areas, a survey has been carried out on local farmers in

the North-West of Italy. The aim was also to determine the local and specific real or potential extra-market functions, related to the socio-economic environment, to be stimulated by financial and political tools.

Materials and methods

A questionnaire was prepared and submitted to a representative sample of local farmers rearing Piemontese cattle and joining to EU Council Regulation 1257/99 on support for rural development stimulating sustainable productive systems adoption. The farms were chosen following the indications of two local Producers Associations and the Breed National Association, and 48 local farmers answered to the questionnaire. In the studied area the number of farmers and animals enrolled in the registry of the Breeders' National Association were about 2,700 and 181,000 respectively (ANABORAPI, 2005), but much more were the farms and the animals not enrolled.

To understand the perspective of growth for a sustainable Piemontese cattle's rearing is essential to know the farms characteristics and their link with the socio-economic environment. So, the surveyed data were: (i) general information on the farms characteristics and typology (management form, total farm area, cultivated areas, production re-employment, workforce, family workers number, plots scattering, etc.) (ii) livestock characteristics (reared species and breed, number of animals and their categories, feeding systems, manure production and management, etc.) and (iii) environmental, territorial and socio-economical functions (extra-agriculture no-paid activity carried out). The link to the socio-economic environment was estimated on the basis of the farmers' answers and the changes in agricultural, livestock, social and economic macro-indexes.

Results and discussion

The farms were prevalently sited in hilly or mountain areas (average farms altitude about 600 m) and their characteristics are showed in Table 1. The greater number of producers joined the organic livestock regulation (EU Reg. 1804/99, financed by EU Reg. 1257/99) and in these productive units, obviously, also the vegetable productions were organic converted. All the farms were family managed and the workforce was prevalently by the family. In fact, only 4 farms had engaged one salary worker, generally employed in animal surveillance on pasture. These findings underline the farm extensive management system adopted. The farmers joined the EU Council Regulation 1257/99 on support for rural development mostly for the financial support assigned by the Region to stimulate the sustainable productive systems adoption, but those that strongly believed in the extensive productive process importance were over 20%. These latest ones represent the producers quota that should proceed with a sustainable method adopted also without public support.

In the investigated areas many farms had little size, but the sampled farms had an average extension of 77 ha. Among the farms, in fact, the middle (30-50 ha) and big ones (50 ha) were the majority, especially due to the large alpine pasture rented. The data was confirmed also by the extension of the pasture area, similar comparing the 50 ha classes. The pasture was used by all the farms, but extensively (low number of animals per hectare, able to preserve the integrity of the pastured surface) only by more than the 50% of the sampled ones also before to join the EU Regulation1257/99. The pasture area (average extension about 54 ha) prevailed over the meadow ones (average extension about 15 ha) and the meadows, at least one per farm, were used both for fresh feeding and hay production. The crop area (average extension about 13 ha) was linked to the farm feedstuffs production. In fact the cultivations were corn (barley and maize) or legumes (protein pea). The corn fields were utilised also for the forage production (maize silage) and some corn derived products were utilised for animal feeding (bran and straw).

A large share of farms (73%) carried on also other cultivations, maintaining a productive diversification. These ones, together to the farms plot fragmentation (the average plots number was 34), assured a balanced, but onerous, soil utilization and a spread of human and animal presence on the territory.

Table 1. Farms characteristics

Investigated aspects	Categories or classes	%
Management form	Property	31
	Rent	17
	Property and rent	52
Productive system	Organic livestock	62
	Conventional livestock	38
Family workforce	1	32
	2	52
	3	14
	4	2
Farms with salary workers	1	8
Reason for EU Reg. joining	Financial support	42
	Personal choice	21
	Others	37
Total farm area	<10 ha	6
	10-50 ha	56
	50 ha	38
Meadow area	<10 ha	54
	10-50 ha	41
	50 ha	5
Pasture area	<10 ha	37
	10-50 ha	32
	50 ha	31
Crop area	<10 ha	64
	10-20 ha	18
	20 ha	18
Orchard and wood area	<5 ha	61
	5-10 ha	11
	10 ha	28
Other plants or non utilized area	<5 ha	83
	5-10 ha	11
	10 ha	6
Pasture managed extensively	Yes	56
	No	44
Plots number	<10	20
	10-30	50
	30	30

Livestock characteristics are reported in Table 2. The number of reared cattle showed a prevalence of medium and big herds. Almost all farms (98%) bred Piemontese cows and only one had also one other beef breed (Limousine). Again, only one farm reared also a dairy breed (Alpine Grey). Considering the little amount of those rearing also others species, as sheep, goat and swine, the examined farms showed a high productive specialization. Concerning the cattle rearing system, the free range system was adopted by a high number of producers, also if the tied stall was still adopted from the majority of them. Nevertheless, in such farms the animals could use pasture or open areas for several months in the year. Moreover, in the mentioned area the animals were normally fed on pasture, also the alpine ones. Such practise was usually adopted also in the studied farms and the alpine pastures were utilised by about 70% of the farmers, allowing the farmers to rear a low number of animal per unit area (for the organic farms the critical limit is normally considered 2 Adult Livestock Unit, ALU, per hectare of Utilised Agricultural Area, UAA). The low number of animals per hectare

could be linked to the soil fertility losses complained by some producers. Such problem is perhaps due to the Piemontese breed frugality that influences the excreta quantity and then the supply of nutrients and organic matter to the soil. In fact, for the Piemontese breed organically reared there is a derogation of the conversion coefficient to evaluate the farm animal load. Moreover, the breed rusticity is important in a sustainable livestock productive system because give the animals a high adaptability to different and poor environments. The produced excreta were exclusively solid manure and it was mainly re-employed on the farm plots. The prudential limit of 170 kg/ha for nitrogen supply was exceeded only in a little number of farms (10%). Only two producers partially sold or exchanged the manure for straw four did not store manure but directly spread it on the soil. Considering the cultivation allotment, only a little number of farms (8%) needed buy forage to partially compensate an insufficient self production, while the feedstuffs self-sufficiency was assured only in the 21% of the farms. Only one farm sold the weaned calves, otherwise the calves were fattened and sold as bulls and rarely as steers or oxen. Although the livestock products transformation was not investigated, in some farms the cows were milked for cheese production ("Bra" or "Castelmagno" PDO cheese and other farm s cheese), sometimes directly sold to the consumers.

Table 2. Livestock characteristics

Investigated aspects	Categories or classes	%
Piemontese cattle number	<10	10
	10-50	50
	50	40
Piemontese cows number	<10	21
	10-50	47
	50	32
Farms with others cattle breeds	Beef	2
	Dairy	2
Farms with others species	Sheep	2
	Goat	4
	Swine	2
Cattle rearing system	Free range	23
	Pens	15
	Tied stalls	62
Cattle on pasture	<4 months	28
	4-7 months	46
	8-10 months	20
	10 months	6
Cattle on alpine pasture	Yes	69
	No	31
ALU per hectare of UAA	<0.5	30
	0.5-1	32
	1-2	28
	2	10
Manure employment	Only on farm plots	96
	Also sold	4
Manure nitrogen soil supply	<170 kg/ha	90
	170 kg/ha	10
Manure storage	Yes	92
	No	8
Purchased feeds	Only forage	2
	Forage and feedstuffs	6
	Only feedstuffs	73
	None	19

In the farmers interviews, the no-paid activity (positive externality by an economic point of view) indirectly developed by the agricultural and livestock presence and their socio-economic repercussion were investigated. The extra-agriculture functions were classified (Table 3) on the basis of their prevalent spin-off in: (i) environmental (ii) territorial (iii) and socio-economical function. Analysing the farmers' activities declared during the interview, among the environmental functions the water management should be stimulated also considering the local recent alluvial events. The stone walls and terracing care should be stimulated because important for territory maintenance and as landscape component with socio-economic spin-off. Several livestock activities develop environmental or territorial functions such as organic matter soil supplies with spread manure, woody fires and avalanches prevention, visual value of rural landscape, territory surveillance, secondary road and path maintenance. For the territorial aspects, only the secondary buildings utilise and care, where the tourist's flow is higher, and the presence of animals in the mountain's landscape should be stimulated. Others functions have repercussions on the local economy and society. So, to stimulate the tourists' visits could be important increase the recreational areas and the farms tourist activity. Also the public support to local and typical livestock production could stimulate the local economy.

Table 3. Benefit linked to the livestock activity with environmental (E), territorial (T) and socio-economical (S) prevalent functions

Benefit	Function	To be stimulated	Link to socio-economic environment†
Water management	E	Yes	M
Dry-stone walls care	E	Yes	M
Terracing cares	E	Yes	M
Country roads restore and maintenance	E	No	H
Territory maintenance	E	Yes	H
Organic matter soil supplies with manure	E	Yes	L
Woody fires and avalanches prevention	E	Yes	H
Areas near untilled fields care	T	No	H
Farm roads system maintenance	T	No	M
Secondary buildings use and care	T	Yes	M
Transhumance paths and roads care	T	No	H
Mountain pasture uses	T	No	L
Farmers at mountain pasture	T	No	L
Animals at pasture by night	T	Yes	L
Farms-tourist paths proximity	S	No	M
Recreational areas presence	S	Yes	H
Farms tourist activity	S	Yes	H
Farm products selling	S	Yes	H

†Socio-economic interaction: L = low M = medium H = high.

Conclusions

Considering the recent changing process of the UE agriculture begun with the new millennium, that seems to show a long-term risks of unsustainability (Hodges, 2005), the presence of a considerable number of Piemontese cattle in local marginal areas, reared in a sustainable way, could represent a deterrent to the territorial damage and could have important repercussion on the local socio-economic environment. The characteristics of the examined farms show the possibility for a development of a competitive but sustainable production, primarily considering the high value of the Piemontese cattle productions and the breed territorial integration. In conclusion, the presence of Piemontese cattle rearing in the traditional breed diffusion areas is important to promote the territorial and landscape maintenance and to avoid a possible biotic and abiotic imbalance. The valorisation of local and typical productions, so as specific financial and political measures recognising the agricultural extra-market functions of such livestock systems, could prevent the reduction of Piemontese cattle in the examined areas and also stimulate and improve the local economy.

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The economic effects of the CAP reform on Aragonese sheep farms

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SUMMARY – The last CAP reform decouples subsidies from production and is, therefore, the most radical reform that has been implemented to date. This reform is generating many uncertainties in the sector and is perceived as a factor that will speed up structural changes. Aragon is an important sheep-farming region in Spain, both in terms of sheep census and the modernity and dynamism of the sector. Based on a sample of sheep farmers located in Aragon belonging to the Spanish "Farm Accountancy Data Network", the implications of the reform have been simulated at farm level, considering several scenarios.

Keywords: CAP, sheep systems, economic results, simulation.

R SUM ***–*** *"Effets économiques de la réforme de la PAC sur les exploitations ovines d'Aragon". Dans la dernière réforme de la PAC les soutiens directs seront découplés de la production, il s'agit, donc, d'une réforme sans précédent. Cette réforme a engendré beaucoup d'incertitudes et peut accélérer changements structurels dans le secteur. L'Aragon est une région espagnole o l'activité ovine est très importante au niveau des effectifs et de la modernité et du dynamisme du secteur. En nous basant sur un échantillon d'exploitations ovines du Réseau d'Information Comptable Agricole localisées dans l'Aragon, on analyse les implications de la réforme de la PAC sur les types d'exploitations, en considérant plusieurs scénarios.*

Mo s s : *PAC, sytèmes ovines, résultats économiques, simulation.*

Introduction

The first Common Organisation of Sheep meat Markets was established in the European Union in 1981 (CEE, 1982) with three supporting pillars: (i) "*general intervention"* in relation to the evolution of the market price, which was never used (ii) the *"incentives"* to exports to third countries, which has been employed on very few occasions and (iii) the *"premium system"* which is still maintained today and has become the only regulating mechanism currently in practice. Three reforms have been introduced since then, the first in 1988 limited the maximum number of sheep per farm eligible for the premium in 1992, the rights system was introduced, and in 2000 the first single premium per sheep system for all countries that includes a supplement for farms in less-favoured areas.

Regardless of the general negative effects that have been brought to the attention of the CAP, the appraisals in relation to the sheep meat sector have, in general, been positive. It can also be said that this sector has been one of the least burdensome for EU budgets. In Spain the CAP for sheep farming has contributed to maintaining farmers' income it has palliated market uncertainties and has permitted the modernisation and capitalisation of farms.

The measures established in the *"ne CAP"* (2003) that will come into force in 2006 will bring about a radical change in the present situation, especially in the channels for sustaining incomes. The most noteworthy characteristic is what has been termed decoupling of subsidies from production. In Spain, in the case of sheep farming, a partial decoupling (50%) has been agreed, that is, the premium is 100% for the flock that is maintained (the mean between 2000 and 2002) and 50% for the flock that disappears. The coupled part implies the commitment to maintain the flock. The period of application will be from 2006 to 2013. Another important characteristic of the reform is *modulation*, which implies an annual reduction of the premium over this period of time (3% in 2006 4% in 2007 and 5% from that year onwards). The application to sheep farming of other aspects such as cross-compliance or those referring to rural development are not specified.

With regard to the expectations and business behaviour of farmers, the reform introduces more uncertainties. The freezing and gradual reduction of subsidies with market-liberalising objectives, may also be interpreted as a de-incentiving measure that may accelerate the process of withdrawal from the sector, distorting its structure and creating difficulties for those businesses that remain active.

When considering the behaviour of family-run farms it must be taken into account that apart from economic factors they are affected by many others of a sociological or psychological nature (McGregor *et al*., 1996 Gil *et al*., 2003). However, the measures introduced by economic policy and their incidence on economic results, in so far as they can determine farm sustainability, may have a decisive influence.

The aim of this work is to carry out an initial evaluation of the possible economic incidence of the CAP reform (2003) on sheep meat farms in a Mediterranean region and, in particular, on farmers' disposable income (Net Value Added +depreciation).

Material and methods

The results of the samples of Aragonese sheep farms of the Farm Accountancy Data Network (2002) have been used as the basic information (RCAN, 2004). We have considered mean data referring to the whole sample and to farms of 8<16 and 16<40 European Size Unit (ESU), as equivalent to those of the three standard farms. The mean characteristics that form the initial situation in the analysis are shown in Table 1.

These are farms with agricultural land. The greater surface area of the largest group is due to tenancies. Work is of a family nature and employed labour does not exceed 10% of total availabilities. Total work availabilities are far from proportional to the economic dimension or to the flock. Total output per head is slightly higher in the group of the smaller farms but the difference is greater if we consider animal output only. The percentage of total revenue accounted for by the subsidies is slightly more in the group of larger farms. Unlike revenue, costs per head are higher in the larger farms. Moreover, in these farms, subsidies account for 84% of Net Value Added, compared to just 60% in the smaller ones.

Based on the initial situation of these three *"farm types"* the evolution of their annual disposable income (revenue less costs) has been estimated to the year 2013, measured in current values of 2005. The farm structure has been considered to be stable (except for the flock when this is indicated) and invariable with regard to functioning, technical results, cost structure, etc.

Three hypotheses have been considered: (i) that farms maintain their sheep farming activity with the same flock size (ii) that they abandon this activity but continue with the agricultural activity of the farm and (iii) that as well as withdrawing from this activity the farmer has a remunerated job outside the farm (taking up half of his day's work) and receives half of the average guaranteed annual interprofessional wage. Throughout the period studied, each farm receives the modulated premiums to which it is entitled, as established by the new CAP reform. Revenues are maintained constant in nominal values and the costs increase by 1% per year. Annual disposable income is calculated at the present value (2005) in accordance with the following formula:

$$\text{Present Disposable Income} = \frac{I_n - C_n}{(1+k)^n}$$

where I_n = Total revenue year n (2006 to 2013)
C_n = costs year n
k = discount rate established

The discount rate includes annual inflation previsions of 3% up to 2009 and 2.5% for the rest of the period up to 2013 as well as 3% capital interest and 2% business risk.

Table 1. Average characteristics of Aragonese sheep farm types (2002)

	Smaller size†	Larger size††	Aragón
No. farms	13	31	53
Structure			
Utilized agricult. area (ha)	26.0	40.4	35.4
% own land	76.2	51.7	59.3
Sheep	379	822	542
Labour input (AWU)	1.1	1.3	1.2
Paid labour input	0.0	0.1	0.1
Revenue ( )			
Total output (sales)	23,095	47,860	32,983
% animal production	95.3	92.4	94.3
Subsidies	12,331	27,014	17,594
% crops	6	5.3	6
Total revenue	35,426	74,874	50,577
Animal output/sheep	58.1	53.8	57.4
Inputs ( )			
Crop specific inputs	759	1607	1.136
Livestock specific inputs	10,709	30,135	19,076
No specific inputs	2,504	8,508	5,780
Depreciation	611	2,935	2,188
Interest and financial charges	49	958	597
Taxes	96	354	209
Total inputs	14,728	44,497	28,986
Livestock specific inputs /sheep	28.3	36.7	35.2
Economic results ( )			
Disposable Income	21,309	35,034	24,966
Net Value Added (NVA) †††	20,698	32,099	22,778
NVA / AWU	18,816	36,815	27,486
% subsidies / revenue	34.8	36.1	34.8
% subsidies / NVA	59.6	84.2	77.2

Source: RCAN (2004).
†<8<16 ESU (9,600-19,200 Gross Margin) †† 16<40 ESU (19,200-48,000 Gross Margin)
††† Net Value Added: Total revenue-Total inputs.

Results and discussion

The results of the simulations are linked to the calculation hypotheses. The simulations of economic results are sensitive to the evolution in prices, both those of productive factors and raw materials and of production. The hypotheses of price previsions considered in this initial analysis are simplistic and pessimistic, although the annual percentage of premium modulation established does not seem to be definitive and it could finally be greater.

The results indicate that the CAP reform has a significant impact on sheep farmers' income especially due to the reduction in the subsidies received (Tables 2 and 3). Throughout the period the subsidies are reduced by up to 65% compared to the those of the base period, i.e. to an annual mean accrued rate of 4.4%. In the case of the hypotheses that consider withdrawal from the activity, the reduction is obviously greater. In this case the subsidies received in 2013 will amount to 34.5% of those initially received (accrued annual rate of 8.2%). It must be taken into account that these percentages refer to the monetary units of each year, whilst their reflection on disposable income is in current values.

The reduction of subsidies is decisive in the considerable decrease in disposable income, considering their relative weight in the global income of farms and their participation in the formation of income over the past few years.

Table 2. Evolution of disposable income (present value 2005) (000)

Year	Larger sheep farms			Smaller sheep farms		
	No change Hypothes. 1	Abandonment Hypothes. 2	Abandonment Hypothes. 3	No change Hypothes. 1	Abandonment Hypothes. 2	Abandonment Hypothes. 3
2006	30.18	9.49	12.66	19.88	4.73	7.89
2007	26.58	8.19	11.11	17.83	4.11	7.03
2008	23.41	7.05	9.76	15.99	3.56	6.27
2009	20.61	6.06	8.56	14.35	3.09	5.59
2010	18.66	5.35	7.72	13.26	2.75	5.12
2011	16.48	4.60	6.80	11.96	2.39	4.59
2012	14.54	3.94	5.99	10.79	2.07	4.12
2013	12.81	3.37	5.27	9.74	1.79	3.69

Table 3. Evolution of subsidies (000)

Year	Aragon		Larger sheep farms		Smaller sheep farms	
	No change Hypothes. 1	Abandonment Hypoth. 2 and 3	No change Hypothes. 1	Abandonment Hypoth. 2 and 3	No change Hypothes. 1	Abandonment Hypoth. 2 and 3
2005	17.07	9.05	26.20	13.79	11.96	6.34
2006	16.38	8.68	25.16	13.24	11.48	6.09
2007	15.56	8.25	23.90	12.58	10.91	5.78
2008	14.79	7.84	22.70	11.95	10.36	5.49
2009	14.05	7.45	21.57	11.35	9.84	5.22
2010	13.34	7.07	20.49	10.79	9.35	4.96
2011	12.68	6.72	19.46	10.25	8.89	4.71
2012	12.04	6.38	18.49	9.73	8.44	4.47
2013	11.44	6.06	17.57	9.25	8.02	4.25

If the farming activity is continued, the overall disposable income of farms will have dropped, by 2013, to 42.2% of that of the basis year (a reduction at an accumulative annual rate of 7.2%) Only slight differences have been observed between the groups of small and large farms (47.1% and 45.6% respectively). These differences are explained by the different economic structure of both groups: in the smaller ones greater income is observed, with subsidies having less weight in the total income and with less unit costs per head.

Disposable income plummets in the hypotheses of withdrawal from the activity. In the first case, the set of farms would lose 90.6% of income (91.3% in the case of small farms and 88.9% in the case of large farms) with a mean accrued annual reduction of more than 11%. In hypothesis 3, withdrawal from activity and work outside the farm, the income earned by the farms increases, although it is still far from that obtained from the sheep farming activity. The set of farms would loose, in 2013, 81.8% of annual income (Figs 1, 2, and 3)

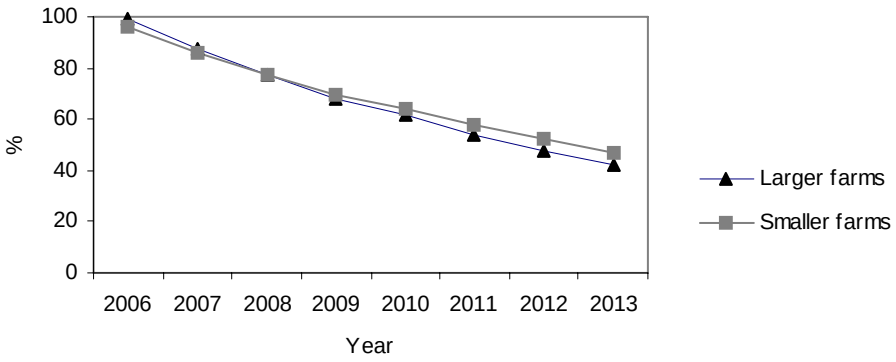

Fig. 1. Evolution of present disposable income. Hypothesis 1 (Basis year 2005=100).

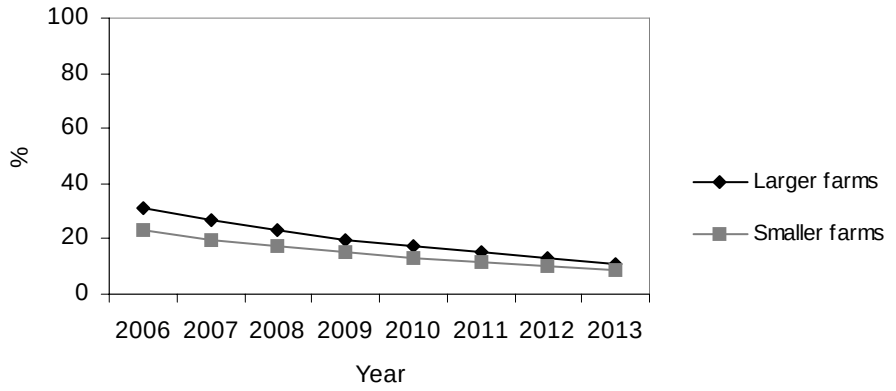

Fig. 2. Evolution of present disposable income. Hypothesis 2 (Basis year 2005=100).

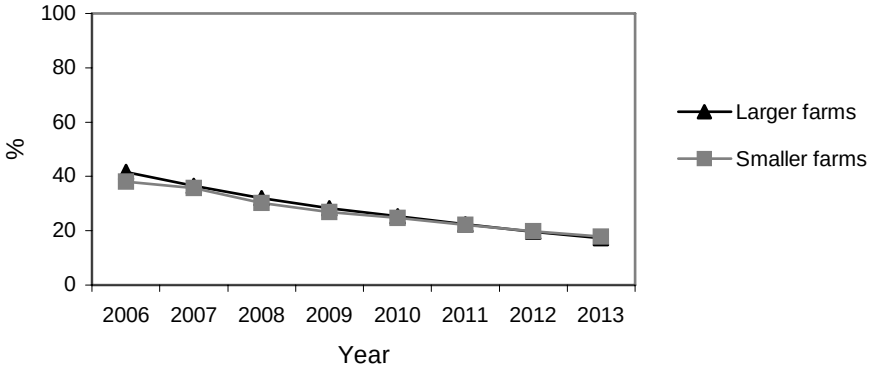

Fig. 3. Evolution of present disposable income. Hypothesis 3 (Basis year 2005=100).

These projections would seem discard the risk that the CAP reform encourages withdrawal from the activity, especially if it is considered for the whole of the period of application. However, on farms with short-term business strategies or particular, sociological or other types of characteristics, the incertitude that the reform provokes may accelerate the process of abandonment of the activity that this sector is experiencing.

We consider that the analysis should be continued, contemplating, at the very least, a more

favourable ratio between prices paid and prices perceived, the increase in the size of the flock and an improvement in the current productive parameters of sheep production.

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Analysis of the contribution of sales of Ternasco de Aragón PGI to the economic results of farms

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SUMMARY – This work analyses the possible influence that the sale of a product with a differentiated quality, the "Ternasco de Aragón" PGI, has on the economic results of a sample of sheep farms forming part of an Aragonese cooperative. Different models of multiple regression are drawn up in which, in addition to the percentage of sales of this product variable, other variables of different types (socio-cultural, structural, commercial, income and costs) that are also considered to be of relevance in explaining farm results, are taken into account. The percentage of Ternasco de Aragón sales is a variable that is explicative of results when the income from subsidies variable is not introduced in the model, otherwise this latter variable has a greater explanatory power, increasing the coefficients of determination of the models.

Keywords: PGI, Ternasco de Aragón, sheep farm, multiple regression.

RESUME – "Analyse de la contribution des ventes de l'IGP 'Ternasco de Aragon' aux résultats d'exploitations des fermes". Ce travail analyse la possible influence que la vente du produit de qualité différenciée, l'IGP "Ternasco de Aragón" a sur les résultats économiques d'un échantillon d'exploitations ovines qui appartiennent à une coopérative aragonaise. On a formulé différents modèles de régression multiple dans lesquels outre la variable pourcentage de ventes de ce produit on a tenu compte d'autres variables de différents types, importants pour expliquer les résultats des exploitations: aspects socio-culturels, structurels, commerciaux, recettes et dépenses. Le pourcentage des ventes de "Ternasco de Aragon" est une variable explicative des résultats quand on n'introduit pas dans le modèle la variable revenu provenant de subventions, dans ce cas cette variable a plus de pouvoir explicatif et augmente les coefficients de détermination des modèles.

Mots-clés : IGP, Ternasco de Aragón, exploitation ovine, régression multiple.

Introduction

Quality policies form one of the basic pillars of the Common Agricultural Policy (CAP). These policies have essentially been promoted due to the beneficial effects that they afford two links in the agro-food chain: producers and consumers. Indeed, products that are covered by Regulations 2081/92 and 2082/92 as well as others that could be termed products with "specific quality characteristics", would enable their producers to obtain a specificity income given the higher prices that consumers would be willing to pay for their differentiating characteristics. This, in turn, would help maintain the social fabric of the rural environment whilst our diet would benefit from products based on techniques of natural preparation that respect the cultural and food traditions of the different EU countries.

After a couple of decades, the volumes of differentiated quality products produced and marketed have increased but, as yet, an analysis has not been carried out on the repercussions that this production has on the economic results of farms. In the Autonomous Community of Aragón, "Ternasco de Aragón" (TA) (Lamb of Aragón) was the first fresh meat in Spain to obtain a Specific Designation (SD) achieving the status of Protected Geographical Indication (PGI) in the European Union some time later, in 1996.

The aim of this study is to analyse how the production and sale of lambs that come within this PGI contribute to the economic results of farms. Up until now research has focused on analysing the repercussions on sheep farms, of sales during the second half of the year when prices are higher, observing a clearly positive effect on the results of farms (Pardos et al., 2004).

Methodology

The farms analysed (119 in total), form part of the technical-economic management programme for meat-producing sheep farms, which has been running since 1993, in collaboration with Carnes Oviaragón farm co-operative and the University of Zaragoza's Escuela Politécnica Superior de Huesca. The farms are located throughout the region of Aragón and the data analysed refer to 2004. The statistical methodology employed has been that of Multiple Regression Analysis. This is a general statistical technique to analyse dependency relationships between a single criterion variable and a set of independent variables (predictors). Its basic formulation is as follows:

$Y_1 = a + b_1 \ _1 + b_2 \ _2 + ... + b_n \ _n$

where values a, b_1, b_2,.....b_n are constant values.

The objective is to use the independent variables with known values to predict a single criterion variable selected. The set of weighted independent variables is also known as the theoretical value of the regression, a linear combination of the independent variables that best predicts the criterion variable (Hair et al., 2000). The sequential search method used has been that of stagewise (stepwise) estimation.

In the study carried out, variables relating to the economic results of farms have been selected as criterion variables and a set of variables which, according to initial hypotheses, are capable of explaining said results have been selected as predictors.

When selecting predictor variables it has been taken into account that it is advisable to choose a sufficient number of variables to avoid specification errors in the model (the most frequent of these being the omission of relevant variables) and, at the same time, that number should be such that, when related to the sample size, the required statistical power is ensured. Given that that the sample size is 119 and there are 8 predictor variables, the ratio is approximately 15 observations per independent variable, which would ensure that the results are generalisable if the sample size is representative.

Results and discussion

Selection of the predictor variables

Along with the % of sales of Ternasco de Aragón variable, a series of variables which, together, would explain economic results obtained have also been chosen. These variables are of different types:

(i) Socio-cultural variables referring to the farmer: age and level of qualification ($_1$ and $_2$ respectively)
(ii) Structural: flock size ($_3$)
(iii) Technical ratios: number of lambs sold per sheep ($_4$)
(iv) Sales analysis: mean price of lamb ($_5$), % sales in the second semester ($_6$) and we also include in this section the % of sales of Ternasco de Aragón ($_7$)
(v) Income: income from the sale of lambs per sheep ($_8$) and
(vi) Costs: total costs per sheep ($_9$).

The variables relating to age and level of qualification of the farmer have been chosen given that a predisposition to participate in a mechanism that differentiates their production, as is the case of the Ternasco de Aragón PGI, could be influenced by this type of characteristics. Similar hypotheses have been considered by some authors (Atance et al., 2003) when studying the differentiation of production in the beef sector. The mean age of the farmers in the sample studied is 45.5 years old and the level of qualification has been rated on a scale of 1 to 10, obtaining a mean value of 6.5. Both variables show little dispersion.

As a structural variable we have chosen the number of sheep in the flock which, as is known, is of

great importance as it is one of the chief differentiating factors of sheep farms (Chertouh et al., 2003). The mean size of the farms that take part in the Programme is 712 breeding ewes, which is greater than the mean size in the region (363 ewes per farm) (Sierra, 2003).

The "number of lambs sold per sheep" variable was chosen as the technical ratio since it largely covers other types of ratios relating to fertility, prolificacy, mortality, etc. The mean is 1.23 which is a figure that coincides with that of 2003 and is also the highest of the last 11 years for which data are available in the Programme. Nevertheless, this variable was finally disregarded as it showed a strong correlation with income from sale of lambs, which was not desirable for the proposed regression model.

Given that commercial aspects are currently of fundamental importance in the study of sheep farming, three basic variables have been considered in the analysis of sales: the mean price of lambs, percentage of sales in the second semester and the % of sales of Ternasco de Aragón variable, the latter being that for which we are interested in measuring its contribution to explaining results. The first two variables are related to each other, given the higher prices of lamb in the second semester of the year however their coefficient of correlation has not been considered high enough to reject one of them. The mean price of lamb throughout 2004 was 61.60 euros and the mean sales percentage in the second semester was 50.4%.

From an exploratory study of the % of sales of Ternasco de Aragón variable, it has been observed that 23.5% of the farms do not market the "Ternasco de Aragón" PGI, although in spite of this fact the marketed mean is 61.2%. If we examine the percentile values we observe that, although 25% of the farms do not sell lamb under the PGI or sell less than 27%, another 25% sell between 27% and 77% and the remaining 50% of the farms sell over 77%. 25% of the farms sell more than 90% of their production under the GPI.

Lastly and given the very definition of the result (gross margin) that we wish to explain, two fundamental variables for its calculation have been taken into account, income from the sale of lambs and total costs per sheep. The income obtained from the sale of lambs is 75.60 euros compared to an income per animal of 115.90 euros. With regards to costs, the total cost per sheep is 89.90 euros, the main component being feed costs: 48.30 euros per sheep.

Contribution to explaining the economic results

The economic results measured on the farms participating in the study are their gross margins either in relation to, in this case the gross margin per sheep, or to the farm. Moreover in each case they are expressed in four different ways depending on whether or not subventions and/or family labour are included or not

Assumptions of linearity, constant variance and normality have been evaluated for the individual variables and for the theoretical value, through residual plots and partial regression plots, the Levene test for homogeneity of variance and residual normal probability plots.

Along with the regression equation, the coefficient of determination and the standard errors in the estimates of regression coefficients are indicated. As is known, the first of these measures the percentage of total variance of the dependent variable explained by the regression model, whilst smaller standard errors indicate more certain predictions.

Although they have not been able to be included, significance tests have been carried out for each estimate of the model, both the Student’s t-test to measure the level of significance of the independent variables introduced and the F values which indicate that the explanation of the variance of the dependent variable obtained by the regression model is significant and to what degree.

Lastly, the degree of co-linearity of the variables has been measured by calculating the tolerance and its inverse, the VIF (variance inflation factor) values. The high tolerance values found point to reduced co-linearity in the variables.

Economic results/sheep

The predictor variables that explain gross margin without subventions are basically income from lamb sales and total costs however, the model differs depending on whether family labour is considered or not. When it is not contemplated in the gross margin, flock size is introduced as an explanatory variable although with a negative sign, decreasing the model's determination coefficient.

Gross margin without subventions and without family labour:

$$Y = 15.078 + 0.923\ _8 - 0.784\ _9 - 0.007\ _3 \qquad R^2 = 0.794$$
(4.758) (0.048) (0.051) (0.002)

Gross margin without subventions and with family labour:

$$Y = -3.126 + 0.985\ _8 - 0.927\ _9 \qquad R^2 = 0.888$$
(3.490) (0.037) (0.039)

In the explanation of gross margin with subventions, the model takes into account the % of sales of Ternasco de Aragón variable and differs, in the rest of the variables, depending on whether or not family labour is considered in the calculation of results.

If family labour is not contemplated, the variables considered are similar to the previous ones: income from sale of lambs, total costs, flock size and, in addition, % of sales of Ternasco de Aragón. If we take into account the remuneration of family labour, the variables are: income from the sale of lambs, total costs, mean price of lamb, % of sales of Ternasco de Aragón and farmer's age.

Gross margin with subventions and without family labour:

$$Y = 45.978 + 0.882\ _8 - 0.729\ _9 - 0.009\ _3 + 0.086\ _7 \qquad R^2 = 0.652$$
(6.837) (0.066) (0.069) (0.003) (0.034)

Gross margin with subventions and with family labour:

$$Y = -7.189 + 0{,}943\ _8 - 0.846\ _9 + 0.722\ _5 + 0.070\ _7 - 0.255\ _1 \qquad R^2 = 0.785$$
(18.709) (0.056) (0.056) (0.289) (0.029) (0.115)

In view of the results, it was considered opportune to introduce the income from subventions variable ($_{10}$) if this is considered to be an integral part of the results. The models are modified as the income from subventions now explains the results, displacing the % of sales of Ternasco de Aragón variable.

Gross margin with subventions and without family labour including, as an explanatory variable, income from subventions:

$$Y = 13.008 + 0.927\ _8 - 0.788\ _9 + 1.057\ _{10} - 0.007\ _3 \qquad R^2 = 0.813$$
(6.054) (0.049) (0.051) (0.103) (0.002)

Gross margin with subventions and with family labour including, as an explanatory variable, income from subventions:

$$Y = -2.718 + 0.984\ _8 - 0.926\ _9 + 0.988\ _{10} \qquad R^2 = 0.893$$
(4.511) (0.038) (0.039) (0.080)

Economic results by farm

If the subventions are not taken into account in the economic results of the farms, the explanatory variables of the model are similar to the results per sheep: income from lambs and total costs, the difference lies in the flock size variable which, in this case, is explanatory when family labour is considered with a negative sign, slightly increasing R^2.

Gross margin without subventions and without family labour:

$$Y = 3126.028 + 599.186\ _{8} - 468.399\ _{9} \qquad R^2 = 0.620$$
(4411.896) (47.278) (49.164)

Gross margin without subventions and with family labour:

$$Y = -3018.511 + 574.251\ _{8} - 496.469\ _{9} - 3.285\ _{3} \qquad R^2 = 0.681$$
(4009.351) (40.779) (42.629) (1.608)

If subventions are taken into account, the variables that best explain economic results are, firstly, flock size, secondly income, followed by costs and lastly % of sales of Ternasco de Aragón.

Gross margin with subventions and without family labour:

$$Y = -4161.375 + 34.903\ _{3} + 606.388\ _{8} - 447.660\ _{9} + 98.600\ _{7} \qquad R^2 = 0.777$$
(6446.507) (2.467) (62.630) (65.365) (32.154)

Gross margin with subventions and with family labour:

$$Y = -8259.469 + 30.657\ _{3} + 582.599\ _{8} - 478.645\ _{9} + 80.072\ _{7} \qquad R^2 = 0.793$$
(5634.876) (2.156) (54.745) (57.135) (28.106)

However, if subventions are entered as an explanatory variable of the results, a slightly different model is obtained, as occurred in the results per sheep. Income from subventions becomes an explanatory variable with a greater predictive value than the % of sales of Ternasco de Aragón.

Gross margin with subventions and without family labour, including income from subventions as an explicatory variable:

$$Y = -27{,}950.55 + 36.253\ _{3} + 635.783\ _{8} - 490.364\ _{9} + 824.294\ _{10} \qquad R^2 = 0.837$$
(6650.699) (2.106) (53.689) (56.249) (113.014)

Gross margin with subventions and with family labour, including income from subventions as an explicatory variable.

$$Y = -30{,}526.09 + 31.839\ _{3} + 610.924\ _{8} - 518.702\ _{9} + 750.829\ _{10} \qquad R^2 = 0.858$$
(5641.937) (1.787) (45.546) (47.717) (95.872)

Although the models have not been validated with another sample, the value of adjusted R^2 has been compared to R^2 and it has been seen that there is very little difference, indicating that the estimated models have an adequate observations/variables ratio in the theoretical value.

Conclusions

The results obtained show the fundamental importance that the income from sale of lambs/sheep and total costs/sheep variables have in explaining the gross margin of sheep farms. Only the size of the flock, measured by the number of sheep, has a greater explanatory power in the farm's economic results, provided that the amount of the subventions received is taken into account in those results. In the rest of the models the size of the flock has little predictive power of the results and a negative sign we have not, however, examined these results as they are not the main objective of the study. The percentage of sales of Ternasco de Aragón is an explanatory variable of results both referring to individual sheep and the farm when the income from subventions/sheep variable is not entered in the model, since in the latter case this variable has a greater explanatory power, increasing the models' coefficients of determination. It is noteworthy that the socio-cultural variables, age and level of qualification of the farmer, have practically no importance in the results.

The analyses carried out are considered to be an initial approach to the study of the importance

that quality products have on the economic results of farms, continued research into this subject being necessary in the future.

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Elevage pastoral et feu agricole en Corse : Vers la maîtrise de la tradition

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RESUME – Elevage pastoral et pratique du feu sont fréquemment associés en Méditerranée et particulièrement en Corse où cependant peu d'études sérieuses y sont consacrées. Un suivi d'élevage (6 exploitations), dans une région pastorale (Nord-Est d'Ajaccio) permet de montrer que l'usage du feu repose à la fois sur des critères physiques (dynamique de la végétation arbustive), technico-économiques (modalités d'occupation spatiale par le troupeau et coût d'intervention) et historiques (tradition). Des perspectives sont avancées pour une maîtrise de l'emploi de cette pratique, au niveau de chaque élevage et à l'échelle collective, pour un maintien pérenne des ressources spontanées.

Mots clés : Elevage pastoral, feu agricole, végétation arbustive, gestion des ressources.

SUMMARY – *"Pastoral stock breeding and burning in Corsica: Mastering tradition". Pastoral stock breeding and burning are often combined in the Mediterranean, and especially in Corsica, here only a fe reliable studies have been conducted about this issue. Six breeding farms located in pastoral areas (NE of Ajaccio) have been follo ed through over the lactation season. his study sho s that the burning activity is linked to physical (shrub vegetation dynamics), technico economic (herd spatial driving and intervention cost) and historical (traditions) factors. Prospects evolve to ards controlled use of burning, at farm level, as ell as on a collective scale for a sustainable management of natural resources.*

Keywords: *Pastoral stock breeding, patoral burning, shrub vegetation, resources management.*

Introduction

En méditerranée, le feu pastoral est en général considéré comme un fléau dans la mesure où il est synonyme de destruction (flore, faune), d'érosion (lessivage du sol), d'agression du paysage (incinération), de dépenses et de surcoûts et parfois à l'origine de drames humains.

Des raccourcis avec l'incendie sont inévitables et l'opinion publique, acquise au discours dominant (Clément, 2005) est particulièrement réactive, voire opposée à l'usage du feu.

Pour autant, des études scientifiques montrent l'intérêt de l'usage du feu, en tant qu'outil, en explicitant les conditions techniques (intensité, régime, saison, etc.), les modalités de conduite, les interventions post brûlage (Rigolot, 1999). Dans l'état actuel, les références sont suffisamment nombreuses pour conclure que l'emploi de cette technique est possible voire préconisée (Di Castri, 1991).

Ce travail s'inscrit dans le cadre de la définition d'une politique récente (PPIFEN : Plan de Prévention des Incendies de Forêts et des Espaces Naturels, document élaboré par le préfet de région : 2005) visant notamment à accorder une place au brûlage dirigé tant dans les élevages pastoraux, dans un premier temps à titre d'expérimentation, que dans l'entretien du sous bois forestier. Cette étude présente les caractéristiques des élevages, les logiques de gestion de l'espace par les troupeaux et les déterminants du brûlage. L'exploration d'améliorations techniques avec une perspective d'organisation des acteurs sur l'objet "feu" est ensuite envisagée.

Matériel et méthodes

Dans le cadre du programme sur la maîtrise du brûlage dirigé mise en œuvre pas les services de

l agriculture du département de Corse du Sud - Direction Départementale (DDAF) et Chambre Départementale (CDA) - six élevages pastoraux sont volontaires pour participer au programme. Durant la campagne laitière (oct. 2004-juillet 2005), des enregistrements de données sur le fonctionnement du système d élevage et des entretiens auprès des éleveurs sur l usage du feu sont réalisés.

Les élevages sont de type pastoral, en zone de piémont, basés sur une race locale de brebis laitière - format, 35 kg poids vif et production annuelle de 120 l - et sur un territoire pastoral (TP) d environ 400 ha, recouvert par une végétation arbustive typiquement méditerranéenne, couramment appelé parcours en raison de sa nature (relief, hétérogénéité du couvert végétal, faible valeur pastorale) et de son mode d utilisation (p turage libre, faible chargement/ha).

Des relevés cartographiques par Système d'Information Géographique (SIG Mapinfo) partir de photographies aériennes (ortho-photoplan, IGN, 2002) sont effectués pour chaque élevage. L ensemble des caractéristiques figurent au Tableau 1.

Tableau 1. Caractéristiques des élevages

levage	UTH	Effectifs†	Surface (ha)	Végétation basse†† (ha)	Arbustive (ha)		Prairie (ha)		Autre††† (ha)
					Basse	Haute	Naturelle	Temporaire	
A	2	120 cap 120 ov	618	183	94	214	52	6	69
B	1,5	250 ov	176	73	52	2	26	20	3
C	2	250 ov 130 bov	853	309	146	233	35	0,0	130
D	2	130 ov	135	117	7	1	0	0	10
E	2	470 ov 100 bov	497	363	57	7	10	0	60
F	2	170 ov	303	215	26	1	0	0	61

†cap =caprin ov =ovin bov =bovin allaitant ††végétation composite dominante herbacée †††Sol nu et végétation de ripisylve.

R sultats et discussion

Les territoires pastoraux (TP) de chaque élevage sont de grande taille (135 850 ha) mais cette surface n est pas toujours utilisable par le troupeau en raison de facteurs naturels (pente, roches, type et densité de végétation) le chargement moyen est faible, même rapporté l espace accessible au troupeau (en moyenne 0.4 UGB/ha/an).

Les surfaces de pente supérieures 30% représentent environ la moitié du TP (Fig. 1). La végétation arbustive est importante (en moyenne 30%) et les surfaces artificialisées (prairies) sont rares et de taille réduite (Fig. 2). Contrairement d autres régions d élevage pastoral (Corse, Provence, Sardaigne) o la tendance est la création d une cellule herbacée sur le TP, (Santucci *et al.*, 2001 Dampne, 2005 Molenat *et al.*, 2005) cet élevage base son système fourrager sur l utilisation de la végétation spontanée avec cependant le recours au feu (Peraudeau, 2005).

Les pratiques de gestion du TP montrent une conduite classique du troupeau qui est relativement libre d'utiliser les différentes faciès de végétation. Pour autant, l'éleveur intervient pour guider son orientation, vers des portions d'espace jugées favorables p turer un instant précis (matin, journée) ou période donnée en cours de la campagne (début de lactation par ex.). Au moment de la mise bas (octobre) et durant la phase d'allaitement des agneaux (durée 45 jours) les animaux, sont affectés des portions d'espace proches de la bergerie. Ils utilisent soit des surfaces en herbe (spontanées ou cultivées) soit du parcours ou les deux. A l'échelle de l'année, le nombre de jours de p turage permis par le parcours peut être de 100%, de 50% ou de 33% selon les élevages.

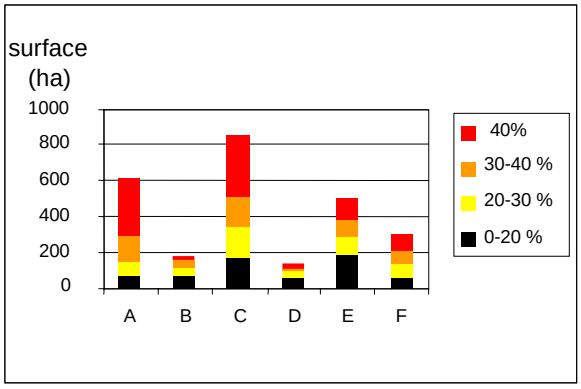

Fig. 1. Pente des territoires pastoraux.

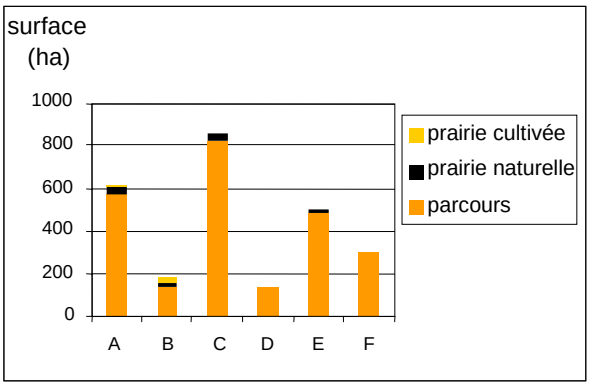

Fig. 2. Composition des territoires pastoraux.

Les données sur les surfaces incinérées (ODARC, 2003) montrent une pression variable du feu. La fréquence sur certaines surfaces est élevée (Fig. 3).

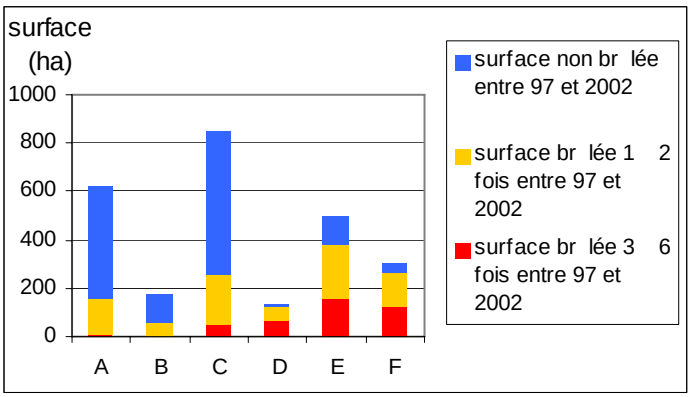

Fig. 3. Fréquence des br lages (1997-2002).

Les informations sur l'argumentaire du br lage font appara tre un ensemble de critères qu'il est difficile de hiérarchiser a priori (Fig. 4). Il nous semble distinguer deux catégories, l'une caractère "structurel" (pente, densité végétation, précarité du foncier, équipement) qui est déterminante sur d'autres techniques de gestion de la biomasse que pourraient utiliser l'éleveur (gyrobroyage, mise en labour). Les facteurs investissements, nature et temps de réponse des interventions, absence de matériel sont des éléments de décision pour l éleveur. L'autre relève davantage du fonctionnel (entretien, ouverture, élimination d'une plante toxique) qui est raisonnée en référence au cycle animal, aux besoins des animaux.

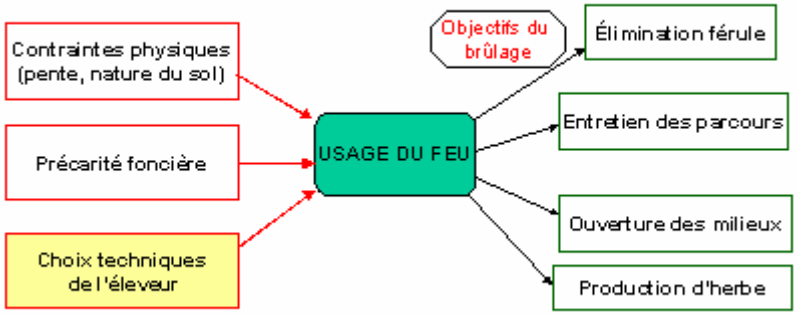

Fig. 4. Les déterminants du br lage.

La perception de ces deux ensembles par l'éleveur, semble pouvoir renseigner les choix techniques mis en uvre et qui s'appuient également sur la tradition, facilement mobilisée : *"le feu a toujours existé"*. Autrement dit, dans l'état actuel, il appara t, pour l'éleveur, que l'usage du feu présente moins d'incertitudes que d'autres techniques.

pour un levage durable : La ma trise de l usage du feu

Les résultats montrent que les zones de parcours constituent le support organique de l'élevage de cette région. L'alimentation du troupeau, calculé en journées de p turage repose sur les ressources spontanées. Les contraintes de divers ordres (physiques, techniques, etc.) et les objectifs de l'éleveur pastoral (conduite d'un troupeau laitier) font que le recours au feu est une pratique nécessaire. Le feu est donc considéré comme la moins mauvaise solution, en terme de marge d'action. Si les investigations sont encore insuffisantes, l'on peut cependant s'interroger sur la pérennité des ressources soumises la pratique du br lage dont le corps de règles ne serait pas formalisé et contr lé. La littérature fournit des connaissances (concepts, méthodes, outils) qui permettent d'instruire des décisions et des actes techniques. En Corse, leur mise en uvre se heurte depuis longtemps (Barouch, et de Montgolfier, 1988) une question d'organisation (profession agricole faiblement structurée sur la question du r le des parcours) et de modèle technico-politique en place : choix exclusif de la création de prairies *via* la suppression de la strate arbustive par traitement mécanique (gyrobrage).

La situation actuelle de la zone d'étude, avec d une part, une profession agricole en déclin (effectifs, organisation) des enjeux spécifiques la région (urbanisation et autres activités humaines), des attentes sociétales en matière de gestion des ressources (biodiversité, paysages) d autre part, indiquent que l'élevage pastoral doit montrer des signes forts d'ancrage au territoire. La ma trise du br lage, tant sur le plan technique qu'organisationnel constitue l'objet de la démarche en cours sur la base d un dispositif multi-acteurs.

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Future prospects and maintenance of goat farming in mountainous areas: A quantitative analysis

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SUMMARY – Based on a survey of 170 goat stockbreeders in the mountainous rural areas of the Spanish Betic Massif, this study aims to identify which herd and farmer characteristics are related to future prospects and the likelihood of goat farming continuing, by fitting an ordered multinomial probit model. Some conclusions and recommendations are finally drawn both for improving the operation of these farms as well as for taking full advantage of the potential of the goat farming sector in the design of sustainable development policies for south-eastern Spain's mountainous areas.

Keywords: Goat-farming sector, future prospects, Murciano-Granadina breed, maintenance of goat farming, Mediterranean mountainous areas.

RESUME – "Perspectives de futur et continuité de l'élevage caprin dans des régions montagneuses : Analyse quantitative". Dans cette étude, à partir d'une enquête sur 170 exploitations d'élevage caprin dans les régions rurales de montagne du Massif Bétique espagnol, on présente les résultats d'un modèle probit multinomial ordonné, pour identifier les facteurs, en relation avec l'exploitation et l'éleveur, qui déterminent les perspectives de futur et de continuité de l'activité caprine. Finalement, des conclusions et des recommandations ont été présentées pour l'amélioration du fonctionnement de ces exploitations, ainsi que pour profiter du potentiel du secteur caprin dans l'élaboration des politiques de développement durable des zones de montagnes méditerranéennes.

Mots-clés : Secteur caprin, perspectives de futur, race Murciano-Granadina, continuité de l'activité caprine, zones de montagnes méditerranéennes.

Introduction

According to the 2003 Livestock Census, Andalusia is the region with the biggest goat population in Spain, accounting for only 18% of total Spanish area, just under 50% of all Spanish goats (totalling 1,349,811 goats) and generating almost 60% of national milk production (259,132 million litres in 2002) (MAPA, 2003). The opportunities for the goat milk sector in Andalusia are sizeable, as there are several autochthonous breeds. Of these the "Murciano-Granadina" and the "Malagueña" breeds stand out. They are the predominant pure breeds, accounting for over 70% of total population. Their excellent milk-producing ability, as well as their outstanding adaptation to all climates, have meant that these breeds are expanding throughout the whole country and are even well-known internationally.

The eastern Andalusian mountains are a typical example of areas in which the goat-producing system, still quite closely tied to rural culture, has in many cases been an important component of local economies. The depopulation of mountainous areas over the last few decades, as well as the changes in cultural patterns within rural populations, has led to far-reaching transformations of goat management systems (splitting of herds, disappearance of traditional grazing patterns, emigration-induced shortages of herdsmen, etc.). This sank goat farming into a crisis from which it showed no signs of recovery until recently. This upturn was not unconnected with European aid and rural development policies.

Furthermore, it is worth mentioning that a major problem facing anyone undertaking an analysis of goat farming systems is that there is not very much information about the economic structure and problems of farms particularly in less favoured mountainous areas. This shortage of information

largely limits the analysis of what effect rural development and farming policies are likely to have in these areas. The generation of economic information about goat production is generally quite unsatisfactory, there being almost no studies that are linked to mountain goat farming. There is, on the other hand, plenty of scientific literature on a range of technological issues concerning management and production systems.

Despite the above-mentioned shortage, there have been attempts at approximating an analysis of goat production systems from a very wide range of viewpoints. In this context, Falagan (1998), for example, studies the recent changes in milk goat-rearing systems in Spain, with emphasis on the "Murciano-Granadina" breed and the region of Murcia. Likewise, Morand-Fehr and Lamboley (2000) and Morand-Fehr *et al*. (2003) attempt to characterise the different goat milk production systems that are present in the Mediterranean. In this fashion, Calatrava (1982), De Maan (1998), Gousidos *et al*. (1998), Spathis *et al.* (1998), Matossian (2000), Pelant (2000) and Calatrava and Sayadi (2003, 2005a,b) are some of the few papers that analyse the socio-economic impact of goat-raising systems and related activities on rural development from different perspectives. In this context, the work by Calatrava (1982), De Maan (1998) and Pelant (2000), Calatrava and Sayadi (2003, 2005a,b), Sayadi and Calatrava (2005) and others attempts to illustrate what role goat farming and related activities play in local development.

Based on a survey of 170 goat farms in the mountainous rural areas of the provinces of Granada and Malaga (south-eastern Spain), we try to identify what farm and farmer characteristics are related to the future prospects and likelihood of goat farming being continued. For that purpose an ordered multinomial Probit model was assessed. Finally, some conclusions and recommendations are put forward to enable the design of future strategies for both improving the operation of these farms and to take full advantage of the potential of the goat sector in the design of sustainable development policies for the mountainous areas of the Mediterranean.

Methodology

The data used in this paper were collected from the information gathered in a survey of 170 goat farmers operating in the mountainous rural districts of the provinces of Granada and Malaga (south-eastern Spain). This survey was conducted in autumn 2005, the aim being for the surveyed farms to be representative of the different production systems and herd sizes in the area rather than forming a strictly representative sample of the population in terms of herd sizes.

The questionnaire used was divided into four major sections. The first was designed to ascertain general information about the technical characteristics of the farm (farm type, number of animals, area and land tenure system, infrastructures, etc.). The second section was intended to identify the goat production and management system (grazing, housing, feeding, reproductive cycle, etc.). The third section included questions related to the product type and marketing systems. Finally, the fourth section aimed to find out what the socio-demographic traits of the respondent farmers were (age, educational level, agricultural training, type of employment in farming, etc.), as well as their opinions and attitudes concerning the prospects for the continuation of farming in the future, reasons for keeping goats, receipt of European aids, etc. This paper presents only a reduced part of the information gathered by the survey.

Conventional statistical tests (χ^2, etc.) were used to analyse the data and an ordered multinomial probit model was fitted to identify which farm and/or farmer characteristics shape future expectations and prospects for the continuation of farming.

For this purpose, the "future continuation of stock farming" variable, CONTHERD, was considered as a qualitative dependent variable, the levels of which were coded as follows:

"CONTHERD" = 0: The farmer will abandon farming before retirement.
"CONTHERD" = 1: The farmer will not abandon farming, but envisages that the farm will go out of business in the future due to discontinuation.
"CONTHERD" = 2: The farmer will continue with goat farming in the long term and does not envisage that the farm will go out of business in the future.

The explanatory variables that the model specification accounted for initially were: farm type (Typefarm), making a distinction between goat only and mixed goat and sheep or other farms goat breed (Breed) years employed in farming (Yearsfarming) employment type (Dedicafarm) farm size: no. of breeding females (Herdsize) access to land (Landpos) access to milking machine (Milkmach) housing (Housing) type of labour used in the production process: family/hired (Labour) farmer's age (Age) educational attainment (Educ) marital status (Mstate) no. of children (Child) attendance of agricultural training courses (Agrtrain) and membership of a milk marketing cooperative (Coop). Table 1 lists these variables, as well as the different levels taken by the multinomial variables.

Table 1. Definition of the explanatory variables of the ordered multinomial probit model (Dependent variable "CONTHERD": future continuation of goat farming)

Variables	Description
Constant	Constant term
Typefarm	1, if the farm is goat only (monoactivity) and 0, otherwise
Breed	1, if the breed is Murciano-Granadina, and 0, otherwise
Yearsfarming _1	1, if the goat farm has been in operation for less than five years, and 0, otherwise
Yearsfarming _2	1, if the goat farm has been in operation for 5 to 10 years and 0, otherwise
Yearsfarming _3	1, if the goat farm has been in operation for over 10 years and 0, otherwise
Yearsfarming _4	1, if stockbreeder has always kept goats, and 0, otherwise
Dedicafarm	1, if stockbreeder is only full-time employment, and 0, otherwise
Herdsize	Size of goat farm (no. of breeding females)
Landpos	1, if stockbreeder has land, and 0, otherwise
Milkmach	1, if stockbreeder has a milking machine, and 0, otherwise
Housing	1, if there is full housing, and 0, otherwise
Labour_1	1, if goat keeper has no hired labour (farmer only), and 0, otherwise
Labour_2	1, if goat keeper employs permanent or casual family labour, and 0, otherwise
Labour_3	1, if goat keeper employs permanent or casual hired labour, and 0, otherwise
Age_1	1, if aged $\leq$ 35 years and 0, otherwise
Age_2	1, if aged from 35 to 45 years and 0, otherwise
Age _3	1, if aged from 45 to 55 years and 0, otherwise
Age_4	1, if aged $\geq$ 55 years and 0, otherwise
Educ_1	1, if stockbreeder is unqualified or have primary education, and 0, otherwise
Educ_2	1, if stockbreeder has secondary education, and 0, otherwise
Educ_3	1, if stockbreeder has university education, and 0, otherwise
Mstate	1, if goat keeper is married and 0, otherwise
Child	Number of children
Agrtrain	1, if the farmer regularly attend agricultural training courses, and 0, otherwise
Coop	1, if the farmer is a member of a milk marketing cooperative and 0, otherwise

Results

A multinomial probit model has been fitted to identify the farm- and farmer-related characteristics that most influence the future maintenance and continuation of farming. The specification of this model is detailed in the methodology. The results of this model, confined to the significant variables, are shown in Table 2.

There is a logical direct relationship ($p = 0.0236$) between the size of the herd and the continuation of the farm business. Additionally, a higher stock housing level ($p = 0.0263$) implies a greater likelihood of farming continuing.

Attendance of agricultural training courses is also directly related to the future continuation of the farm business ($p = 0.0031$) in the sense that the continuation of farming is significantly greater among

farmers participating in agricultural training courses (goat operation start-up and modernisation, etc.) than those who do not regularly attend. In some cases, farmers participate in these courses to get European aids and subsidies for which they qualify by attending. These aids result in the modernisation of their farms and investments in plant and equipment, which means that they usually have bigger plans for the future with a view to amortising the incurred expenses.

Table 2. Results of the "Goat farming continuation" multinomial probit model

Variables	Coefficients	t	p
Constant	2.18049162	5.148	0.0000
Herdsize	0.490903954	2.264	0.0236
Housing	0.562464403	2.222	0.0263
Labour_1†	-2.64752081	-2.840	0.0045
Labour_2	-.295700614	-1.576	0.1151
Age-1††	0.906814958	3.999	0.0001
Age-2	0.541219281	2.325	0.0201
Age-3	-.397852398	1.185	0.2359
Agrtrain	0.826135	2.959	0.0031
Child	0.906814958	3.999	0.0001
Coop	0.438723	2,451	0.0142

† Labour_3 reference variable (farming with permanent and/or casual hired labour).
†† Age_4 reference variable (farmer 55 years).
Log likelihood function: - 67.51221 Restricted log likelihood: - 116.1759 Chi-squared: 74.96863
Degrees of freedom: 10 Significance level: $p \leq 0.001$ PCC: 80.12%.

Additionally, the surveyed herds whose owners are members of a milk marketing cooperative are the farms that have greater prospects for continuing with the farm business ($p = 0.0142$). This is, without doubt, because of the high level of satisfaction, the commercial protection and/or greater added value afforded by this form of commercialisation, as well as the advice they receive from cooperative specialists.

There is also a very significant ($p = 0.0001$) and quite logical direct relationship between the number of children the farmer has and the likelihood of continuation of the farm business. This finding also ties in with what we observed in field work, as some farms remain in the hands of the same family for several generations. Additionally, many owners (27%) state in the questionnaire that they keep goats on the grounds of "tradition and inheritance".

With respect to the multinomial variables included as independent variables in the model (owner's age and farm type by labour) that turned out to be significant for explaining future prospects, and after making the respective adjustments by changing the reference levels, we found that: (i) more commercial farms (employing casual and/or permanent hired labour) have a significantly ($p \leq 0.01$) greater likelihood of continuation than farms that do not employ such labour (herds kept by just the farmer or possibly with family help) and (ii) farmers aged over 55 years are more pessimistic about the future of the farm than keepers aged under 35 years.

Apart from identifying the factors related to the future continuation of the farm, the estimated probit model can be used to calculate the likelihood of a given farmer and farm being optimistic about the future upkeep of the farm. Therefore, for example, the probabilities for a goat keeper aged over 55 years, who is not a member of a milk marketing cooperative, does not regularly participate in agricultural training courses, has an extensive farm with a herd of under 50 head, employs no labour apart from his or her own work and has no descendants, would be as follows:

P (abandonment of farming before retirement)	=	0.214
P (farming will not be abandoned, but the farm is likely to go out of business)	=	0.701
P (long-term continuation of goat farming with little likelihood of the farm going out of business)	=	0.085

On the other hand, the probabilities for a 35-year-old goat keeper, who is a member of a milk marketing cooperative, regularly participates in agricultural training courses, has a herd of over 500 fully housed goats, employs hired labour and has 4 children, are as follows:

P (abandonment of farming before retirement)	=	0.002
P (farming will not be abandoned, but the farm is likely to go out of business)	=	0.145
P (long-term continuation of goat farming with little likelihood of the farm going out of business)	=	0.853

Conclusions

There is a tradition of and experience in raising goats in the mountainous rural areas of south-eastern Spain, based on autochthonous stock farming, although it has been very much affected by the rural exodus and the resulting arable and stock farming crisis (land abandonment, shortage of grazing land, shortage of labour, etc.).

A direct scale effect on the prospects for continuation of farm businesses has been found.

Future prospects and the likelihood of continuation of goat farms in the area is linked to the size of the herd, the type of stock management and the type of labour used in the farms, the owner's level of agricultural training, milk marketing cooperative membership and the number of children in the family unit.

The farmer's age is indirectly linked to the maintenance of goat activity. Stockbreeders less than 35 years are more optimist about the future of the farm than keepers aged over 55 years.

Neither the type of herd (simple or multi-purpose), the breed, the length of time the farm has been in operation, part- or full-time employment in goat farming, mechanical or not milking, the owner's general educational level, influence the farmer's intentions of continuing with the goat farm business.

Generally, future expectations are not very optimistic, as the risk of disappearing goat farming has been detected to be very high.

Despite the above, it can be said that the sector does have some future potential, as a group of more dynamic young goat keepers have started up operations over the last few years. These stockbreeders have modernised their farm, improved stock management techniques and taken on hired labour.

To improve the future prospects of goat farms and assure their future continuation, rural and agricultural development strategies should aim to increase herd size, improve the qualifications and training of herdsmen and women and goat farmers, target available aids towards restructuring the sector and getting young goat keepers to start up market-oriented commercial farm businesses and towards promoting quality products, as well as supporting cooperatives in the sector. Apart from all this, these measures will maintain the rural population and the resulting local knowledge of stock farming management and utilization, as well as the tradition of goat farming and the area's autochthonous "Murciano-Granadina" and "Malagueña" milk-producing breeds.

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Dairy cattle systems in Morocco as affected by structural adjustment policies

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SUMMARY – Since the early eighties, structural adjustment policies have been applied to the agricultural sector in Morocco. This has progressively led to the suppression of all kinds of incentives at farm level. As a consequence, cattle systems have been forced to adapt themselves to survive. This paper discusses the diversity of dairy cattle production systems in Morocco. It analyses their functioning parameters (feeding, reproduction, rearing practices) and the productive performances (milk yield per cow, meat production) they achieve. It also evaluates their gross profitability. Then, the perspectives of the economic sustainability of each system are analysed in the frame of the on-going changes affecting the local milk market (free trade agreements). Finally, recommendations are made to assist the prevailing cattle systems in coping with these structural changes.

Keywords: Structural adjustment, dairy cattle, typology of farms, profitability, milk yield.

R SUM **–** "Systèmes d'élevage bovin laitier au Maroc corcernés par des politiques d'adjustement structurel". Depuis le début des années '80', des politiques d'ajustement structurel ont été appliquées au secteur agricole au Maroc. Ceci a induit un gel progressif de toute subvention à l'échelle des exploitations agricoles. Les systèmes d'élevage bovin laitier ont ainsi été contraints de s'adapter pour survivre. Cet article présente la diversité des systèmes bovins au Maroc. Il décrit leurs performances techniques (rendement laitier et production de viande) et leur rentabilité, à la lueur de l'analyse de leurs paramètres de fonctionnement (alimentation et reproduction). Les perspectives de durabilité économique de chacun de ces systèmes sont ensuite discutées, eu égard aux changements actuels affectant le marché local des produits laitiers (ouverture des frontières). Finalement, des recommandations sont présentées pour assister les systèmes d'élevage bovin laitier à composer avec la nouvelle conjoncture.

Mo s s : Ajustement structurel, bovins laitiers, typologie d'exploitations, rentabilité, rendement laitier.

Introduction

Since Independence, in 1956, Morocco has paid careful attention to rural development, because of its weight in general political affairs (Leveau, 1972). Consequently, ambitious agricultural development plans have been adopted (i.e. milk, sugar, cereals plans) to secure food supply for a rapid growing population and to ensure labour for peasants. These plans were heavily supported by state incentives in order to promote local production and to protect it from imported goods. Most of the efforts were concentrated in irrigated schemes where water availability was meant to secure crops (Amri, 1991). Such a policy has led to a successful improvement in domestic production of raw agricultural goods This has maintained the supply of domestic markets with local goods above 60%, for strategic ingredients, such as raw milk, and has also created many labour opportunities.

However, since the early eighties, following the recommendations of the international banking institutions, a drastic structural adjustment program (SAP) was implemented in Morocco, to balance expenses with the country's sources of income. As a consequence, laws were adopted to liberalize progressively trade and to suppress all kind of incentives. This was particularly evident for inputs, which prices often increase, without such an increase in agricultural products prices (Akesbi, 1997).

This paper discusses the consequences of the SAP on cattle farms diversity in Morocco and analyses their perspectives, considering future developments that might affect local farming business, mainly free trade agreements with the USA and the EU.

Dairy cattle farming in Morocco before SA

Dairy cattle farming in Morocco is recent. Before colonization, and even with the presence of foreign settlers, very few experiments of intensive milk production were realized. That was due to local food habits, based on cereals and meat, and also because of sufficient milk production by local cattle breeds for a limited population (until 1956, there were only 11 millions inhabitants). However, with the end of colonization and the growth of population at a rapid pace, coupled to urbanization (32 millions in 2004 of which 18 millions of urban citizens), local politicians had to cope with an increasing demand in animal proteins. Consequently, modern poultry production and dairy cattle were intensively encouraged. Hence, in 1975, Moroccan authorities officially launched "the dairy plan" (MARA, 1975). It consisted in a series of measures destined to promote milk production, collection, industrial treatment and consumption. Those measures were strengthened by market protection from imported milk powder. At farm level, the Moroccan state provided a favourable frame for dairy production with incentives on the inputs (feed, milking machinery and imported heifers). It also created an interesting climate for the investors in the sector with an adequate price policy, as raw milk sold by farmers represented almost 75% of the value of milk purchased by the consumers (Table 1). Furthermore, efforts were made by state technical services to promote the constitution of milk collection centres (from 4 in 1970 to more than 900 in 2004), to get raw milk sold, in every location of the countryside. A rapid growth of milk production was noticed, nationwide, even in places which were not suitable for intensive dairying, as many farmers took loans from banks for that goal (El Mesmoudi, 1982).

Table 1. Evolution of milk prices from the producer to the consumer in Morocco

Year	Production price (1) (Moroccan dirham)	Consumption price (2)	(1)/(2) (%)
1970	0.54	1.05	51.4
1975	0.90	1.20	75.4
1980	1.44	2.10	68.6
1985	2.05	3.10	66.1
1990	2.62	4.10	63.9
1995	2.94	5.00	58.8
2000	2.94	5.40	54.4
2005	2.94	6.00	49.0

Dairy systems with high merit cows were at that time of limited productivity (< 3 000 kg/cow/year), at the exception of some farms which benefited from intensive technicians' advice. The first diagnosis all showed that State incentives, mainly on feed inputs, created a situation where farmers were not encouraged to produce in satisfactory ways. Even if many farms were making economic profit with such a business, that profitability was totally "artificial" (El Khyari, 1987). Moreover, some farms have developed in totally unfavourable areas, only converting subsidized feed concentrates into milk. This has led to a growing number of farms with acute reproduction problems, mastitis, and deceiving milk yields (Lakhdissi *et al*., 1988), and with bad milk quality.

When SAP measures began to be implemented, one of its first victims was the "Comagri" (Compagnie Marocaine de Gestion des Exploitations Agricoles), which was an important State society, especially devoted to intensive dairying promotion. It managed a dairy herd of more than 3 300 cows in 12 farms throughout the country. Whenever considering its performances, it appears that average annual milk yield was low (less than 3 000 kg/cow), and reproduction suffered severe disorders, as the average interval between calving was more than 410 days (Bradly, 1978).

SAP measures early implementation in the beginning of the eighties was unfortunately characterized by a period of intense drought in Morocco, which resulted in a clear decrease in the number of cattle population (Fig. 1). This drought has also induced a slowdown in the rhythm of milk production and furthermore the imports of dairy heifers were disrupted (Guessous, 1991). At the end of the eighties, SAP measures were all well established with the total suppression on incentives on

dairy production inputs and milk price was liberalized. Thus, it was decided to get an agreement on milk production price between farmers' unions and milk industrials. Practically, this had led to an increase in the margin of milk transformation by the industrial sector, reflected by the growth of the purchase price by consumers whereas the price destined to farmers remained unchanged (Table 1).

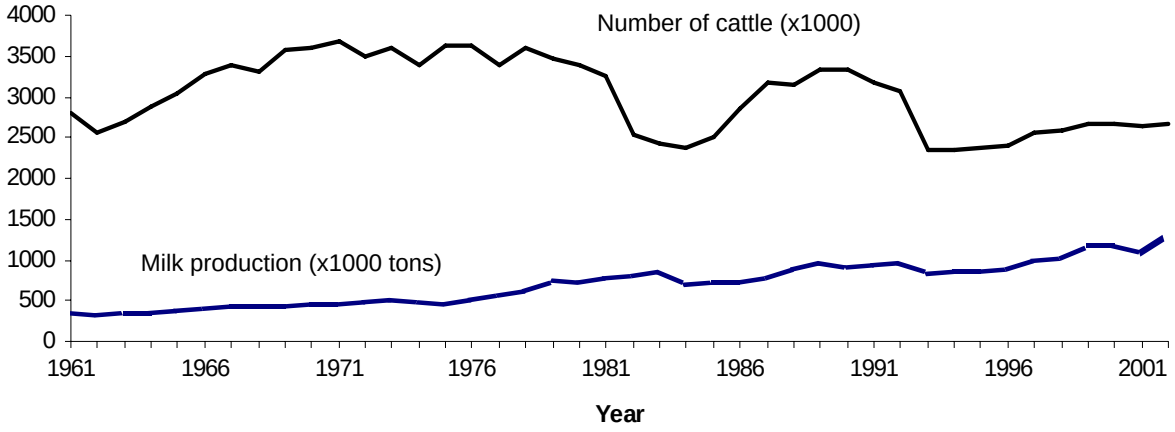

Fig. 1. Evolution of milk production and of the number of cattle in Morocco.

A typology of dairy cattle farms in Morocco after SA

After the implementation of SAP measures, some subsequent changes were noticeable in the Moroccan cattle farms. Studies on the typology of farms show a broad variety of strategy production. These could be depicted as follows (Sra ri *et al*., 2003 Sra ri and Lyoubi, 2003):

(i) *a minority of speciali ed dairy farms* (less than 20% of total cattle farms), with an average annual *milk yield per co superior to 4 000 kg* and with *significant profitability* (more than 500 Euros/cow/year)

(ii) *mixed meat/milk* production with *lo inputs*, which are generally making *substantial profit* (+250 Euros/cow/year)

(iv) *lo milk productivity* (2500 kg/cow/year) associated to *important use of purchased concentrates* and with *negative economic results* (-150 Euros/cow/year)

(v) *mainly meat production* with very *lo milk yield* (<1500 kg/cow/year) and with *positive economic results* (+ 300 Euros/cow/year).

On the addition of these four cattle rearing trends, a special system was identified. It was represented by state farms owned by the "SOD A" (SOciété du D veloppement Agricole), with a very distinct type of dairying: important amounts of concentrates very efficiently converted to milk (Sra ri and Kessab, 1998). In June 2005, this society, which was managing more than 60 000 ha of irrigated land and with a dairy herd of more than 1200 cows, has been dismantled. These five types of dairy farming were obvious in all the production contexts prevailing in Morocco rainfed and irrigated areas.

Compared to the performances of dairy farms before SAP, it appeared that some improvement was achieved, mainly dealing with milk yield per cow. This could be partly explained by the increase in the genetic merit of imported cows. In addition, the most decisive factor was certainly the adoption of rationale dairying practices. In fact, dairy farmers had to improve their production techniques by the adoption of modern ration formulas. Those skills in feeding were forced to cope with the scarcity of roughage, which is general in Moroccan farming conditions: smallholder farms, aridity and limited forage cultivation and conservation know-how. Consequently, important amounts of concentrates are used in specialized dairying systems (more than 5 tons of concentrates per cow/year in SOD A farms

for an average milk yield of 6 tons per cow/year). This means that milk production is nowadays closely correlated to concentrates consumption (Fig. 2), particularly in the context of suburban farms or in rainfed areas (Sra ri, 2004), where concentrates play a buffer role to attenuate drought consequences on roughage production (Sra ri and El Khattabi, 2001).

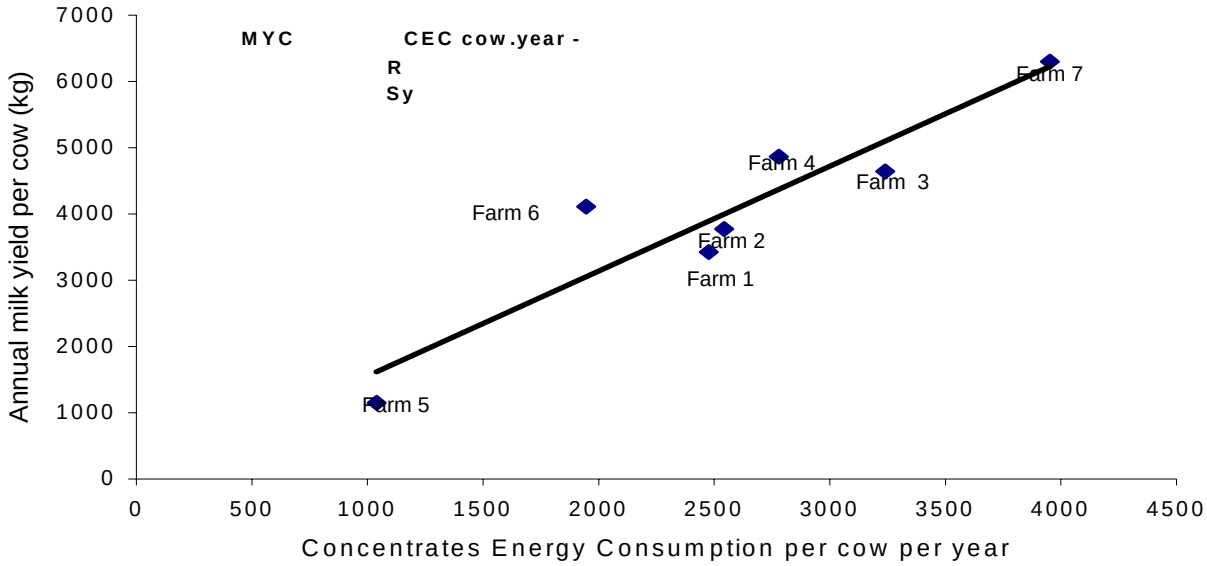

Fig. 2. Relationship between concentrates energy consumption (CEC) and milk yield per cow (MYC) in seven Moroccan suburban dairy farms (Sra ri, 2004).

All together, these results of dairy farms' typology in Morocco, whenever compared to the same results before SAP application, show that these measures had a tremendous impact on the sector. It appears that the suppression of incentives has induced a better feed conversion efficiency, mainly in highly specialized dairy herds. This is obvious whenever considering milk yield or feed formulas used by dairy farmers. Otherwise, in the cattle systems which did not have the technical or financial abilities to adopt modern dairying techniques, production strategies more typically devoted to meat production, even with high merit dairy cows, have been adopted. In fact, it is known in Morocco that beef still comes from herds classified as dairy, in a context of total absence of beef breeds imports, and with local cattle breeds of limited weight gains aptitudes.

erspectives of dairying in Morocco under an open market

Dairy specialization, even if it concerns limited numbers of cattle farms, is the most evident result of SAP measures on the sector. On another hand, cattle farms which could not follow those measures and their impact on input prices, had to convert themselves to more extensive systems, paying more attention to meat. Hence, as observed in many other countries which were forced to adopt SAP measures, this policy was not successful to enhance, in all kind of farms, dairy productivity. It was even rather unpopular because of the increase of the prices of inputs (Meertens, 2000). However, and it is particularly true whenever analysing specialized dairy farms' performances, the SAP policy has allowed to establish rationale rules in dairying instead of subsidizing inefficiency. Another consequence of SAP in the Moroccan dairy sector is that it has not decreased the number of farms dealing with that business, but many of them had to change the way it produces milk.

At present time, as most Moroccan industrial milk plants are establishing close links with international dairy groups, and as the consumers are getting more and more aware about quality, there are growing concerns about that feature. This will certainly be a decisive issue for the future, perhaps as important as the increase of volumes, because it is a key figure to generate more income in the whole sector. Unfortunately, because of the inheritances of the past (the "dairy plan" almost

exclusively emphasized on milk quantity), this aspect of milk quality has been very rarely treated at farm level. The rare available references agree that milk hygienic quality is bad (Ounine *et al*., 2004 Sra ri *et al*., 2005). Moreover, these studies both indicate that it is not linked to structural parameters in the farm (i.e. the number of cows or land tenure), but it is determined by hygiene practices. Thus, further extension efforts are still needed, in a context of thousands of smallholder farms which produce limited quantities daily. This will surely constitute an opportunity for dairy farmers, mostly for those aware about quality and its requisites, as it will allow them to negotiate with industrials and look for better price for high quality milk. But this requires to implement a quality payment system which will have to be fair for all kind of farmers, and which takes into account the diversity of milk samples.

Conclusion

SAP has had an obvious effect on cattle systems in Morocco, as it has induced the end of all direct protection on the prices of the inputs they use. As a consequence Holstein cattle systems have been forced to specialize themselves in dairy production with higher milk yields. This has induced better annual profitability per cow for those farms. Otherwise, cattle farmers who could not or did not want to follow those measures had to look for alternate production strategies such as mixed milk/meat systems or only meat production. Future challenges related to the Moroccan cattle sector are linked to the continuation of the increase of milk yield per cow, also to milk quality improvement, and to global competitiveness in front of imported milk. As free trade agreements with the USA and EU are to be implemented for the whole agricultural sector in proximate years, this will arise serious uncertainties for dairy farmers. It is quite certain that they will have to search for a significant improvement of the quality of raw milk as they will have to continue to decrease the cost of milk production by higher conversion efficiency of feed to milk. These will certainly constitute decisive technical challenges, as they will necessitate higher skills in a specific context of aridity and forage scarcity, far different from western dairy production models.

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L'élevage ovin viande dans les régions méditerranéennes françaises : Entre filières et territoire

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RESUME – A l'échelle de la France, sur les 15 dernières années, l'élevage ovin a relativement mieux résisté dans les régions méditerranéennes. Cette résistance s'est appuyée sur une grande diversité de systèmes d'élevage mais aussi sur des stratégies de filières et des types de produits caractérisés eux-mêmes par une grande diversité. Parallèlement, l'accès au 2ème pilier de la PAC a été un atout pour des exploitations d'élevage situées le plus souvent en zone défavorisées, utilisatrices de surfaces hétérogènes et de parcours. Les conséquences de la dernière réforme de la PAC, les perspectives incertaines du 2ème pilier, le rôle que pourront jouer des productions identifiées, etc. sont autant d'éléments qui contribueront à dessiner les scénarios d'avenir pour les exploitations ovines de ces régions, dans leurs équilibres entre filières et territoire.

Mots-clés : Exploitations ovines, pastoralisme, agri-environnement, filières.

SUMMARY – "Sheep breeding in the Mediterranean regions of France: industry and tradition". For the past fifteen years, sheep breeding systems in the Mediterranean area have stood up quite well compared to those around the rest of France. This resistance is due to a large diversity of livestock systems and types of products as well as markets. At the same time, the second pillar of the CAP has helped farming systems located in these disadvantaged areas and using rough lands. The consequences of the last CAP reform, the second pillar's future development, the future impact of identified lamb productions, etc., are some of the key elements that will build up scenarios for the future of sheep breeding systems in these areas.

Keywords: Sheep breeding, pastoral farming system, agro-environment, production network.

Une évolution des élevages ovins qui a singularisé les régions du Sud de la France

Entre 1988 et 2000 à l'échelle de la France, le nombre d'éleveurs de brebis nourrices a baissé de 43% et le cheptel brebis de 21%, mais avec une diversité inter-régionale. Dans les zones relativement secondaires pour cette production, la décroissance s'est poursuivie, notamment avec la régression des petites troupes ovines "de complément". Des régions très ovines, comme le Limousin ou Poitou-Charentes, ont connu aussi des évolutions très négatives, au profit du labour et du bovin allaitant (Institut de l'Élevage, 2002) (Table 1).

A l'opposé, résistent mieux des régions de montagne (Sud Auvergne et Sud Rhône-Alpes) et les zones sous influence méditerranéenne à fortes contraintes pédo-climatiques, telles les zones des Causses au sud du Massif central et, en particulier, le Sud-Est de la France.

Parmi les facteurs multiples qui peuvent contribuer à l'explication de cette spécificité, on notera certes le fait que, dans ces régions, les alternatives de production sont peu nombreuses : faible disponibilité en surfaces aptes à assurer des stocks de qualité pour le lait ou à être reconverties en cultures de vente, présence de parcours et d'alpages, instauration des "quotas" de primes en bovins allaitant qui a freiné le développement de cette production dans des secteurs traditionnellement plus moutonniers.

On notera aussi qu'existaient des marges de manœuvre en matière de restructuration et de productivité du travail : en Provence- Alpes-Côte d'Azur (PACA) par exemple, la taille moyenne des troupeaux a ainsi cru de 69% entre 1988 et 2000.

Nous développerons 2 facteurs, parmi d autres, qui semblent jouer un r le important dans les régions ovines du Sud-Est : les souplesses possibles dont disposent les exploitations ovines dans leurs rapports aux filières et dans leurs rapports au territoire.

Table 1. Evolution régionale de la production ovine entre 1988 et 2000 (Institut de l Elevage d après Agreste-recensements agricoles. SCEES)

Zone	Nb d éleveurs en 1988	Cheptel Brebis "viande" 1988	Evolution Nombre d éleveurs entre 1988 et 2000	Evolution cheptel brebis "viande" entre 1988 et 2000
France entière	153 900	6 581 000	- 43 %	- 21%
Limousin	11 330	779 500	- 41%	- 30%
Poitou-Charentes	13 540	942 200	- 54%	- 35%
Auvergne	9 800	586 300	- 39%	- 8%
Rh ne Alpes	11 140	360 400	- 39%	- 10%
Midi-Pyrénées	14 090	989 600	- 35%	- 12%
Languedoc-Roussillon	2 380	247 400	- 26%	- 13%
Provence Alpes C ted Azur	3 560	596 000	- 37%	+2%

Des r gions en d ficit et une diversit de produits et de fili res

Alors que la consommation moyenne de viande d agneau par an et par habitant dans les régions de PACA et du Languedoc-Roussillon (L-R) sont supérieures la moyenne (autour de 10 kg en PACA contre moins de 5 kg en moyenne fran aise), la production régionale y est largement déficitaire, avec des taux d approvisionnement inférieurs 30%.

Cela entra ne des tonnages élevés de viande (en vif ou carcasse) en provenance des autres régions fran aises ou de l étranger, sous forme assez souvent d agneaux "standard". Cela laisserait la possibilité la production régionale d occuper, sur le créneau "agneau lourd", une position particulière, et de jouer la marge sur des produits originaux qui n ont pas forcément leur correspondance ailleurs. Mais plus généralement, ce type de déséquilibre entre offre et demande pose des questions de "visibilité" de la production régionale pour les distributeurs et les consommateurs régionaux et de capacité pour les structures d amont de la filière d assurer une régularité dans l approvisionnement des circuits commerciaux.

Les agneaux finis rustiques du grand sud (Préalpes, Mérinos d Arles, Blanche du Massif Central, etc.), peuvent, en fonction de l ge, du sexe et du type de race ou de croisement, recouvrir un éventail assez large de caractéristiques. En moyenne, les agneaux dits "lourds" se situent des poids inférieurs la moyenne nationale : autour de 15-16 kg contre 18 kg.

Autre particularité : la part de la production sous forme d agneaux "légers" mais finis, vendus moins de 90 jours et avec des poids de carcasse de 12-13 kg en moyenne, est supérieure. Ce type de production, soit traditionnel (dans les Pyrénées Orientales), soit avec un positionnement commercial récent, en partie pour contrer "l évasion" des agneaux export, rencontre le segment de clientèle méditerranéenne réputé attiré par une viande jeune et claire. Il permet des arrêts d allaitement précoces et l ge de vente des agneaux limite leur niveau d alimentation, en concentré mais aussi en fourrages.

Enfin, en fonction de la conjoncture économique (prix pratiqués) mais aussi des conditions de production (état des stocks fourragers par exemple) des agneaux légers (finis) ou maigres (non finis) peuvent être exportés, principalement vers l Espagne et accessoirement vers l Italie, pour être consommés No l ou P ques, ou pour un engraissement de finition.

Ainsi, dans la BDN[1], les profils d ateliers "légers" (élevages qui vendent en moyenne 50% de lourds et 50% de légers) ou maigres (50% de lourds et 50% de maigres), bien que minoritaires partout, sont notablement mieux représentés en PACA et LR que dans la plupart des autres régions (Fig.1.)

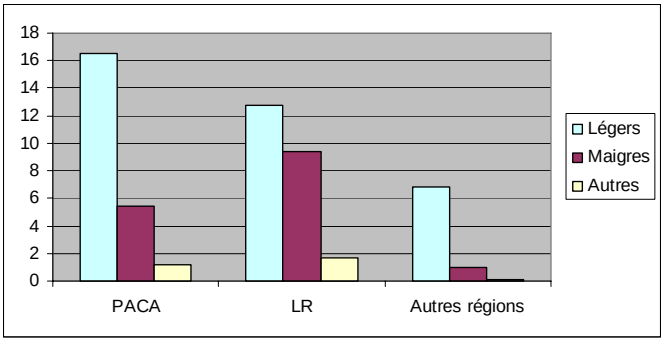

Fig. 1. % des élevages suivant le profil de vente d agneaux, hors élevages dominante "lourds" (source : BDN ovin viande, Campagne 2004).

Cette diversité (certes toute relative) et les poids moyens des agneaux sont, n en pas douter, la fois : (i) un mode de réponse une diversité de la demande et/ou le signe d une offre particulière qui parvient trouver une demande (ii) l illustration d une difficulté pour certains systèmes d élevage dominante pastorale s en tenir, de fa on variable suivant les années, un type de production trop rigidement normé et homogène mais aussi (iii) le témoin de l existence de marges de man uvre dans le type de productions mettre sur le marché et dans les possibilités de différencier les circuits de commercialisation.

Sur le plan des filières, 2 stratégies extrêmes (avec de multiples variantes) co-existent. La première autour de circuits plut t longs, avec des opérateurs privés ou des organisations économiques qui jouent souvent la carte collective d une identification des produits. La seconde, certes loin d être dominante, plut t autour de circuits courts, avec un fort marché de proximité. Cela peut concerner notamment des types d animaux originaux (en correspondance avec certaines traditions de consommation ou certaines clientèles). Dans ce contexte, il n est également pas rare de rencontrer des élevages qui jouent plusieurs cartes simultanément ou en fonction du profil climatique de l année (vendre plus de légers si les stocks fourragers sont faibles), de la conjoncture, des types d agneaux (les agneaux doubles partiront plut t non alourdis, les agneaux qui "poussent" bien plut t dans les filières qualité, etc.), des résultats l agnelage, etc. Au del de l aspect opportuniste de ce type de rapport au marché et sa variabilité dans le temps, sa souplesse constitue un atout pour des systèmes d élevage. Cela peut poser néanmoins des questions aux filières organisées qui souhaitent des volumes et des types de production plus homogènes et, si possible, tout l année.

Des strat gies d alimentation des troupeau ui n cessitent des s curit s

L ensemble des systèmes concernés recouvre une diversité liée, nous l avons évoqué, aux types de produits et aux filières, mais aussi au territoire disponible et aux rapports l espace ainsi qu aux modes de conduite du troupeau qui souvent s en déduisent.

A titre d exemple (Réseaux d Elevage, 2004), dans les systèmes de type "herbassier", en plaine littorale, l éleveur donne la priorité l économie des intrants au prix d une forte mobilité spatiale : parcours de printemps, alpages d été, regains p turés des prairies de fauche sur l automne-hiver, etc., Les races sont rustiques, l agnelage dominant l automne, les types d agneaux produits et les circuits de commercialisation d une grande variété. Forte mobilité et importance de la garde caractérisent ce type d élevage extensif, très faiblement utilisateur de stocks. Les effectifs du

[1]BDN : Base de Données Nationale qui recueille les données technico-économiques de près de 4500 élevages ovins en "appui technique", représentatifs des élevages "professionnels" fran ais.

troupeau sont généralement importants, de 600 1200 brebis. Les b timents et le matériel d exploitation sont réduits au strict minimum.

Autre exemple, le système sédentaire en moyenne montagne méditerranéenne. Il s appuie sur un équilibre en surfaces fauchables, en quantité limitée (14 brebis/ha en moyenne), et des surfaces de parcours diversifiées et vise l autonomie alimentaire. Ce système adopte 2 périodes d agnelages équilibrées, centrées d une part sur les regains et les prairies irriguées en fin d été-début d automne et d autre part en février-mars, en bergerie. Les agneaux sont conduits en bergerie et vendus un poids moyen de 15-16 kg de carcasse, souvent dans le cadre d une démarche "qualité". Ce système allie des phases nombreuses extensives (les parcours sont utilisés pendant au minimum 6 mois de l année, notamment en fin de printemps-été et partiellement en hiver) et des phases plus intensives pour la lactation des mères ou l engraissement des agneaux.

La majorité de ces élevages ont ainsi en commun une composante pastorale qui se trouve parfois renforcée par des pratiques de p turage hivernal (Gautier, 2004). Soumis des influences climatiques méditerranéenne et/ou montagnarde, avec de fortes variations inter annuelles possibles, les systèmes d alimentation mobilisent des sécurités plus pastorales que fourragères. Cela passe par le recours plus ou moins fréquent au gardiennage partiel ou permanent des troupeaux. La garde, même si elle pèse sur l organisation du travail, constitue en effet un des moyens de valoriser des surfaces o la cl ture est difficile envisager (statut foncier très précaire, faible "potentiel" de ressources, etc.).

Une autre caractéristique de ces élevages est dans la composante "extensive" de la conduite du troupeau. Vu les conditions de production, et notamment d alimentation, la plupart des éleveurs privilégient des objectifs de productivité proche d un agneau par brebis et par an. Peu ou pas d accélération dans le rythme des mises-bas, recherche d une prolificité modérée, mise en reproduction relativement tardive des agnelles (18 24 mois pour l ge la première mise-bas) sont des choix qui permettent de conserver la souplesse et la capacité d adaptation annuelle indispensables dans un contexte de forte utilisation de ressources pastorales. Ces conduites extensives induisent un rapport particulier des élevages avec les filières de commercialisation et un mode d élaboration spécifique de leurs résultats techniques et économiques. En comparant les résultats moyens / brebis des élevages en BDN "appui technique" de PACA et L-R avec ceux des autres régions de France, on constate des taux de productivité numérique (nombre d agneaux produits / 100 brebis) significativement inférieurs dans les régions du Sud-Est et en particulier de PACA. Ces résultats s expliquent la fois par des taux de mise bas annuels (nombre de mise-bas par an / 100 brebis) et de prolificité moins importants (Fig. 2).

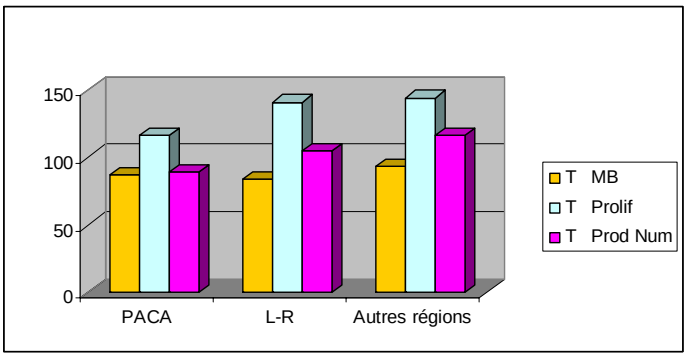

Fig. 2. Résultats zootechniques moyens/brebis (Source : BDN appui technique 2004).

La productivité du travail dans les élevages est obtenue en jouant plus sur le nombre de brebis par travailleur que sur le nombre d agneaux produits par brebis. On retrouve l une des explications de l augmentation importante de la taille moyenne des troupeaux constatée sur ces quinze dernières années, d autant que les mécanismes de primes, d indemnités et d accompagnement financier des éleveurs ont été aussi des ressorts puissants dans la dynamique de croissance interne des cheptels.

Des rapports au territoire originau

Outre leur situation en zones dites défavorisées soumises la déprise ou la dépopulation (l exception notable des élevages de la plaine littorale), ces systèmes présentent des caractéristiques assez originales dans leurs rapports aux territoires, et notamment aux espaces pastoraux. Ces derniers, milieux "naturels", couvert végétal spontané, fréquemment très hétérogènes, sont supports de biodiversité faunistique et floristique et constituent des composantes fortes des ensembles paysagers (Beylier *et al*., 2002). Leur statut foncier est complexe : les éleveurs, rarement propriétaires, sont conduits mettre en uvre des conventions de p turages souvent originales avec les propriétaires fonciers privés ou publics. Autre particularité des élevages de ces zones pastorales : la (nécessaire) prise en compte du multiusage dans des territoires o l agriculture, et notamment l élevage, est désormais loin d être la principale activité économique alors que c est elle qui occupe, avec la forêt, le plus d espace. Cela conduit la multiplication des interlocuteurs sinon des partenaires (forêt, tourisme, chasse, services de défense de la forêt contre les incendies, etc.) et au développement des interventions agri-environnementales. Les mesures agri-environnementales, diversement initiées (Dobremez et Perret, 1998), se sont ainsi multipliées dans les régions du sud de la France et dans leurs élevages. Entre autres parce que l accent y était mis sur les externalités positives de l élevage (entretien de l espace), que certaines pratiques demandées étaient assez proches de celles préexistantes, qu il y avait déj une habitude de prise en compte des demandes de la société environnante, etc. Et que l on disposait d innovations, en termes d équipements (cl tures permettant de libérer du temps de travail et de mieux tenir le troupeau sur des portions d espaces- Institut de l Elevage, 2001 CERPAM, 2001), en termes de références sur les milieux pastoraux (Institut de l Elevage, 1999) et de procédures ou de réglementations (Conventions de p turage, groupements pastoraux, associations foncières pastorales), en lien parfois avec des projets locaux favorisants (Tchakérian, 2004).

Ainsi (Institut de l Elevage, 2006), dans les exploitations ovines spécialisées des réseaux d élevage, dans les zones pastorales les aides totales atteignent en moyenne 45 50% du produit brut (contre 30 40% ailleurs, hors montagne), et celles du 2nd pilier représentent 45 50% de ces aides (contre 25 35% ailleurs, hors montagne).

our l avenir

Comme dans les autres régions de France, la production ovine rencontre la question de la productivité du travail. Une des particularités des systèmes pastoraux étant l utilisation de vastes surfaces faible potentiel, l amélioration des temps et des conditions de travail passe par la réduction des t ches de gardiennage. Le développement des cl tures, la sécurisation de contrats de mise disposition de foncier, les aides la réouverture de certains milieux embroussaillés vont bien s r dans le bon sens. Reste que la concurrence forte sur le foncier (due tant aux autres éleveurs qu aux autres usages possibles – tourisme, résidences, etc.) empêche l accès certains espaces ou la réalisation d investissements "lourds". La tendance l augmentation continue des cheptels par unité de main-d uvre atteint également parfois des limites sur le plan économique : indemnités de handicap l ha et non plus la brebis, découplage 50% de la prime la brebis et de la prime supplémentaire, etc. Il y a l probablement de nouvelles cohérences examiner entre performances zootechniques, co ts de production et taille des troupeaux. L émergence, peut être aussi, d une nouvelle dynamique d élevages ovins complémentaires d autres activités ou en substitution partielles de productions très découplées.

Sur le plan des filières, il ne fait pas de doute que les modes de production rattachés cet élevage ovin pastoral bénéficient d une image de marque positive. C est une carte fréquemment jouée par les organisations de producteurs et la distribution. Le développement de circuits courts conduit cependant les organisations économiques, la recherche d effectifs d agneaux minimum et d une certaine régularité d approvisionnement, trouver, l aussi, de nouveaux équilibres.

Les systèmes ovins méditerranéens ont bénéficié de certaines des mesures du 2nd pilier de la PAC, notamment en matière d entretien des espaces pastoraux. Les incertitudes actuelles sur le financement du Développement Rural iront-elles jusqu des scénarios relativement pessimistes quant l importance de cette carte "territoriale" ?

Sur tous ces points, la question de la résistance dont la production ovine a fait preuve dans le Sud-Est au cours des années 90 peut donc se poser à l'avenir en termes assez différents.

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SESSION 2

Characterisation of Mediterranean products of animal origin and social demands

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Iberian pig production: The problems of success

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SUMMARY – The Iberian pig constitutes a singular breed, strongly adapted to the ecological conditions of the "Dehesa" ecosystem. This breed includes a number of strains, all of them showing low prolific and growth rates, very early maturing fat deposition, and an excellent meat quality, which is valuated in the market according to the fatty acid profile (palmitic, stearic, oleic and linoleic acids) of subcutaneous fat. This paper mainly deals with available feeding sources of the "Dehesa" for Iberian pigs, the productive features of this breed and the evolution that feeding and production systems have experienced in recent years.

Key words: Iberian pig, production systems, quality.

R SUM – *"Production de porc ibérique : Les problèmes du succès". Le porc ibérique est une race très bien adaptée à l'habitat de la "Dehesa". Cette race y comprend beaucoup de lignées qui sont toutes très peu prolifiques et ont un faible indice de transformation. Elles ont aussi un dép t précoce de gras et une très bonne qualité de la viande très appréciée par les consommateurs. Pour évaluer cette qualité, on a fait le profil des acides gras (palmitique, stéarique, oléique et acide linoléique). Dans cet article sont traités différentes sources d'aliments qui existent dans la "Dehesa", valorisables par les cochons, les caractères de production et l'évolution de l'alimentation et des systèmes d élevage pendant ces dernières années.*

Mo s s : *Porc ibérique, système productif, qualité.*

Introduction

Productive systems based on autochthonous breeds and traditional extensive systems usually have big problems in the commercialization of the products, particularly during the initial stages of high scale commercialization. Atomized production and lack of uniformity makes difficult to reach big consumer markets.

The case of the Iberian pig is an outstanding exception among the many traditional productive systems in Europe. The peculiar characteristics of the breed and productive system lead to high quality meat products. The high acceptance of these products in the Spanish market has allowed the flourishing of a niche market, with increasing importance and very high profits. At the moment, around 2 million Iberian pigs were slaughtered in Spain in 2003 (MAPA, 2004), from which about 15% were fattened under free-range conditions, in which is called "montanera" (fed on acorns and grass in the "Dehesa"), and the other 85% were reared in confinement and fed on mixed diets. Based on these figures, the number of Iberian sows can be estimated in nearly 230,000, which means an increase in the number of reproductive animals of more than 100% compared to the year in which Spain joined the EU (1986). The Iberian swine sector includes a national association of farmers "Asociación Española de Criadores de Ganado Porcino Selecto Ibérico Puro y Tronco Ibérico" (AECERIBER) and four Protected Designations of Origin (Dehesa de Extremadura, Guijuelo, Pedroches and Huelva) which control the trade of high quality meat products (dry-cured hams and forelegs) elaborated under strict norms of animal production and industrial manufacture. Traditionally, carcasses of Iberian pigs were paid to farmers as a function of the genetic features of the animal (pure Iberian, crossbreeding of Iberian with Duroc, crossbreeding of Iberian with Duroc) and feeding system during the fattening, from 100 to 160 kg of live weight, including three different systems: (i) "montanera", in which animals are fed outdoors and consume exclusively acorns and grass (ii) "recebo" (half the time in "montanera" and half time fed on mixed diets) and (iii) fed on mixed diets in confinement. There is

nowadays a uality Norm for the production of Iberian hams, Iberian forelegs and Iberian loins (BOE, 2004) establishing that it is compulsory the use of pure Iberian sows if the meat products are commercialized as "ibérico". In addition, such uality Norm establishes the existence of products of different qualities depending upon the feeding background of the animals ("montanera", "recebo" and on mixed diets in confinement). Moreover, since a few years ago, the payment in the trade of slaughtered Iberian pigs considers the fatty acid profile of subcutaneous fat, the range for each fatty acid within each commercial class is officially published each year.

However, this promising trend in the market of Iberian pig meat products has raised new problems of increasing importance: the imitation of the products and the rise of fake practices in the production and commercialization of the products. In this review we will present the peculiarities of the Iberian pig traditional productive system and discuss the new challenges arising. We believe it is a good example for many other traditional productive systems.

Free-range production

The production of Iberian pig is deeply bound to the Mediterranean ecosystem. It is a rare case in the world of swine production where the pig collaborates significantly in the preservation of the ecosystem. The "Mediterranean forest" is mostly composed of evergreen oaks (*uercus ilex*), cork oaks (*uercus suber*), gall oak (*uercus lusitanica*), arbutus (*Arbutus*) and heath (*Ericeus*). In non-mountainous areas, where the density of trees is low and extensive animal production (cattle, sheep, pigs) have been commonplace for centuries, the Mediterranean forest is called "Dehesa". The available feeding sources for Iberian pigs in this ecosystem are the grass (from October to June), by-products of cereal crops and horticulture during summertime, non harvested figs and olives and mainly the acorns from trees of the genus *uercus*, which are available from November to February. It is estimated that Spain has 2.9 million ha of evergreen oaks and 0.4 million ha of cork trees, of which 2.1 and 0.3 million ha respectively are forming part of the "Dehesa" ecosystem (MAPA, 2001). Of all this area, the surface used for Iberian pig production only represents around 450,000 ha, the remaining being used for bovine and ovine production, for hunting, etc.

Acorn production is highly variable, depending upon the year, the healthiness of the tree, its age, the tree management, the variety of tree and the tree itself (V zquez, 1998). The "Dehesas" containing trees show an average density between 20 and 40 trees per ha, and the average annual production per tree is close to 15 kg, although in some cases the density is much higher (80-100 trees per ha) (Esp rrago *et al.*, 1994). The whole acorn (shell, skin and endosperm) is not totally used by Iberian pigs. The shell and the skin, which constitute around 21-23% of the total weight of the acorn, are removed by the animal while ingesting. The endosperm of the acorn from evergreen oaks shows a 67% of dry matter (81.5% of nitrogen free extractives, 4.7% of crude protein, 6.3% of fat, 5.7% of crude fibre and 1.75% of ash on a dry matter basis) and is very rich in oleic acid (C18:1 n-9) (66% of total fatty acids), linoleic acid (C18:2 n-6) (14.7%), palmitic acid (C16:0) (12.6%) and stearic acid (C18:0) (3.2%) (Rey *et al.*, 1997), although its chemical composition is variable depending on the year and season. According to a recent experiment in which data from three consecutive years were recorded, protein, fibre, fat and oleic acid content of acorns increase during the months the "montanera" takes place (from October to February), while the stearic acid content decreases and that of the linoleic acid kept constant during such period of time (López Carrasco *et al.*, 2005). The grass in autumn and winter, together with the acorns, are the main natural feeding sources on which meat quality of Iberian pig is mostly sustained. Grass consumption is a very important source of protein (137 g/kg dry matter), linolenic acid (C18:3 n-3) (450 g/kg of total fatty acids) and α-tocopherol (171 mg/kg dry matter) (Rey *et al.*, 1997).

It is accepted that the Iberian pig is a single breed, but it includes a number of lines or strains with either red or black skin ("Negra Entrepelada", "Negra Lampiña", "Valdesequera", "Retintas", "Torbiscal", "Alentejano", etc.), all of them being perfectly adapted to the ecological environment of the "Dehesa". The average adult live weight of boars and sows has considerably increased in recent years, being nowadays around 140-170 kg for females and 180-190 kg for males (Daza, 2001). The first mating for sows usually takes place when they are 9-10 months old with 90-100 kg, while males reach puberty at 7-8 months of age. The productive live for sows in the traditional system lasts around 6 to 8 parities, while that of males is around 2-3 years. Iberian breed is not highly prolific (7-9 piglets per farrowing), the litter size increasing with the farrowing number, reaching the maximum between the 5th and the 8th one (V zquez *et al.*, 1994). There are several factors that may influence this

variable, such as season (i.e. temperature) or feeding availability. Benito *et al.* (1992) found the highest prolificity in summer births, while Dobao *et al.* (1983) in winter. Su rez *et al.* (2002) observed that the strains "Manchado de Jabugo" (whose origin is the crossbreeding of Iberian breed with British breeds) and "Torbiscal" showed the highest prolificity, followed by the "Entrepelado" and "Retinto" ones, the "Lampiño" showing the poorest reproductive features. Crossbreeding between different Iberian breed strains improves the prolificity in around 0.5 piglets per litter (Silió *et al.*, 2001) and crossbreeding with the Duroc breed in 2-3 piglets (López-Bote, 1998).

uality characteristics of the products

Growth and development of Iberian pig includes different periods, named "cria", "recria", "precebo" and fattening or finishing. During the "cria" phase (lactation and weaning) the piglet is nursed by the sow from birth (1.2-1.5 kg) to weaning, which is carried out between 28 days (6-7 kg) and 56 days (13-15 kg), depending upon the production system. From weaning to 90 days old (23-25 kg), piglets are usually fed in confinement, with mixed diets containing approximately 3100-3200 kcal ME/kg, 18-19% crude protein and 1-1.2% lysine. During "recria" (23 to 60 kg) and "precebo" (60 to 100 kg) previously castrated pigs are reared and fed in different ways depending on the system in which they are going to be fattened (outdoors in "montanera" or fed on mixed diets in confinement). Pigs intended for "montanera" are allowed to carry out physical exercise in farmyards or even using the available feeding sources of the "Dehesa", and are daily supplemented with 1.5-2.0 kg of mixed diets with 2800-2900 kcal ME/kg and 2.0-2.2% lysine per Mcal of ME (López-Bote, 2001), while those animals intended for being finished indoors on mixed diets, are usually fed in confinement and on a higher daily nutritive level, even *ad libitum*. The feeding level during the "recria" and "precebo" phases affects carcass quality and fatty acid profile of subcutaneous fat, and also to the content of tocopherols in muscle. Thus, Daza *et al.* (2005a) observed a compensatory growth during the finishing outdoors in "montanera", which mainly comprised fat, and higher concentrations of oleic and linolenic acids and of α- and γ-tocopherol in those pigs subjected to lower levels of feeding during "precebo" (Table 1). The recommended feeding strategy for Iberian pigs during the growing phases, despite the animals are aimed for being finished outdoors in "montanera" or in confinement, is a low feeding level, with mixed diets containing low fat, low linoleic and saturated fatty acid concentrations and a moderate high crude fibre levels, contributing to the development of the digestive system (López-Bote, 2001).

Table 1. Major fatty acid composition of subcutaneous outer backfat layer at slaughter and concentration of alfa and gamma tocoferol in *Longissimus dorsi* muscle according to the feeding level prior to free-range period

Fatty acid (%)	Feeding level		SEM	Significance
	High	Low		
C16:0	17.99	17.67	0.16	
C18:0	8.77	9.19	0.25	
C18:1 n-9	55.05	55.99	0.27	*
C18:2 n-6	9.42	8.68	0.35	(1)
C18:3 n-3	0.47	0.55	0.017	*
Σ n-6	9.57	8.82	0.35	(1)
Σ n-3	0.66	0.69	0.027	
Σ n-6/Σ n-3	14.80	12.82	0.62	*
α-tocoph (µg/g)	1.80	2.63	0.17	**
γ-tocoph (µg/g)	0.73	0.84	0.05	(1)

*P < 0.05, **P < 0.01, (1) P < 0.10.

The finishing or fattening phase (100-160 kg) is carried out either outdoors in "montanera" or in confinement with mixed diets. Genetic factors, and other aspects such as sex, age at the beginning of the fattening, age and weight at slaughter, environmental conditions, and so on, have marked effects

on productive results of this phase and on carcass quality. The "Torbiscal" strain shows the best carcass quality characteristics, while the "Negra Lampiña" one shows the worst, although the meat from this latter strain possesses an extraordinary quality, mainly as a consequence of its high intramuscular fat content and distribution (Benito *et al.*, 2000 Muriel *et al.*, 2004).

In production systems for growing-fattening in confinement, the crossbreeding of Iberian pigs with the Duroc breed improves average daily gain, feed conversion and carcass quality (Serrano *et al.*, 2005a,b), although meat quality may be adversely affected. Crossbreeding of Duroc with the "Torbiscal" strain improve carcass leanness, hams, forelegs and loins yield. The average daily gain during the finishing phase is not affected by Duroc crossbreeding (Dobao *et al.*, 1987). The acceptable productive features (average daily gain and feed conversion) and good carcass and meat quality characteristics of the "Torbiscal" strain makes this type of animals one of the most valorated genetic line for boars in Iberian productive systems, as an alternative of the Duroc breed.

The feeding of Iberian pigs during the fattening phase is the most important factor affecting carcass, meat and fat quality. Pigs finished outdoors in "montanera" and exclusively fed on acorns and grass, show significantly poorer average daily gain and carcass and hams, yields than animals fed on mixed diets (Daza *et al.*, 2006) (Table 2), but the fatty acid profile is most appropriate from a technological and commercial point of view (higher concentration of oleic acid and lower of palmitic, stearic and linoleic acids), and the muscle tocopherol content is higher (López Carrasco *et al.*, 2003 Rey *et al.*, 2006) (Table 3). The weight gained as a consequence of acorn and grass feeding, that is, the length of the outdoor rearing in "montanera", also influences the fatty acid profile of subcutaneous fat, and particularly that of oleic acid (Montero de Espinosa *et al.*, 1992), although more scientific knowledge is needed on this topic in order to increase the number of animals yearly fed outdoors in "montanera", allowing optimization of natural resources.

Table 2. Effect of feeding system on growth and carcass characteristics in Iberian pigs

Variable	N†	Feeding system	Value	Standard error
Average daily gain (g)	22	Free-range	501.48[a]	26.02
	21	Confinement	653.36[b]	11.12
Carcass weight (kg)	22	Free-range	121.31	1.76
	21	Confinement	119.79	1.79
Carcass yield (%)	22	Free-range	76.94[a]	0.23
	21	Confinement	77.97[b]	0.26
Hams weight (kg)	22	Free-range	21.52[a]	0.24
	21	Confinement	22.56[b]	0.25
Forelegs weight (kg)	22	Free-range	14.64	0.14
	21	Confinement	14.56	0.15
Hams and forelegs weight (kg)	22	Free-range	36.16	0.35
	21	Confinement	36.82	0.36
Hams†† (%)	22	Free-range	13.79[a]	0.16
	21	Confinement	14.32[b]	0.16
Forelegs†† (%)	22	Free-range	9.42	0.09
	21	Confinement	9.36	0.10
Hams + forelegs†† (%)	22	Free-range	23.25	0.22
	21	Confinement	23.64	0.22
Hams††† (%)	22	Free-range	17.93	0.21
	21	Confinement	18.37	0.19
Forelegs††† (%)	22	Free-range	12.23	0.12
	21	Confinement	12.02	0.12
Hams + forelegs††† (%)	22	Free-range	30.22	0.31
	21	Confinement	30.32	0.25

†N = number of pigs.
††Respect at slaughter weight.
†††Respect carcass weight.
[a,b]For each variable means with different superscripts are significantly different.

Table 3. Major fatty acids composition (%) of the subcutaneous backfat outer layer and α and γ tocopherols (µg/g) of *Longissimus dorsi* muscle according to the feeding system applied during the fattening period

Fatty acid	Feeding system					
	Free-range	Mixed diet†	Acorns†	Acorns and grass†	Root MSE	P
C16:0	19.10^{b}	20.47^{a}	19.16^{b}	19.34^{b}	0.946	0.0001
C18:0	8.74^{b}	9.96^{a}	9.00^{b}	9.45^{ba}	0.864	0.0001
C18:1 n-9	53.09^{a}	47.53^{c}	52.26^{a}	50.75^{b}	1.201	0.0001
C18:2 n-6	10.45^{cb}	12.66^{a}	10.11^{c}	11.43^{b}	1.261	0.0001
α-tocoph	2.21^{ab}	1.79^{b}	2.24^{a}	2.47^{a}	0.57	0.0001
γ-tocoph	0.73^{a}	nsd††^{b}	0.79^{b}	0.84^{a}	0.20	0.0001

†In confinement.
††nsd = not detected.
^{a,b,c}Values with different superscripts are significantly different (P < 0.05).

Evolution of productive systems: The need of continous control

As previously explained, around 85% of Iberian pigs slaughtered in Spain are finished in confinement and fed mixed diets. Three general orientations of feeding practices in the last 50 years can be differentiated into three groups: *traditional feeding, fake feeding* and *promising feeding*.

Traditional feeding was based in the use of mixed diets rich in carbohydrates (barley and wheat) and poor in fat, which leaded to a high consistency in pig fats, which as a consequence of feeding composition were rich in saturated fatty acids, showing melting points above 30°C. This latter criterion was used as a method for identifying the feeding background (either "montanera" or in confinement) after slaughter. Subsequently, since last decade of the 20th century, mixed diets were enriched in unsaturated fats in order to avoid endogenous synthesis and achieve lower melting points, similar (and even lower) to those of fat from pigs fed outdoors in "montanera" on acorns and grass (26-27°C). Feeding sources rich in linoleic acid were frequently used in feed formulation, such as corn, barley, wheat and soya bean. This feeding strategy, which is fake in its purpose, led to an increase in the susceptibility of the meat to lipid oxidation, to an enlargement in the ripening process of hams and forelegs and to a marked decrease in the sensory quality of meat products (López-Bote, 2001).

In recent years there is a trend to include ingredients rich in oleic acid in mixed diets for Iberian pig fattening (lard, oleines, high oleic sunflower oil, peanuts, rapeseed oil), with the purpose of achieving an adequate fatty acid profile and a meat sensory quality similar to that of meat from pigs fed in "montanera". Furthermore, in order to substitute the antioxidant effect of tocopherols form acorns (γ-tocopherol) and grass (α-tocopherol) found in the meat of pigs fed outdoors in "montanera", mixed diets used for feeding Iberian pigs in confinement are supplemented with 100-200 mg/kg of vitamin E (α-tocopheryl acetate). In different experiments in which linoleic acid was replaced by oleic acid in the mixed diets without changing the saturated fatty and the linolenic acid contents, and feeding was supplemented with supranutritional levels of vitamin E, an increase in oleic acid and a decrease in linoleic acid in subcutaneous and intramuscular fat, together with a decrease in the susceptibility of meat to lipid oxidation (due to an increase in muscle and microsome α-tocopherol), a lower Σ(n-6)/Σ(n-3) fatty acids ratio, and an improve in some rheological properties of subcutaneous fat, such as consistency, elasticity, cohesiveness and adhesiveness (López-Bote *et al.*, 2002, 2003 Daza *et al.*, 2005b) was achieved. As expected, the influence of vitamin E supplementation in these experiments led to a reduction in the susceptibility of pig tissues to lipid oxidation. It has been also observed an interaction between the level of vitamin E in the feeding and the ratio oleic/linoleic acid, so that the lower the vitamin E inclusion in the feeding and the lower the monounsaturated fatty acids/polyunsaturated fatty acids (MUFA/PUFA) ratio, the lower the muscle microsomes α-tocopherol concentration, leading to an increase in the prone of the meat to get oxidized (López-Bote *et al.*, 2003). An example of the influence of dietary partial replacement of poly-with monounsaturated fat on fatty acid profile of subcutaneous backfat is presented in Table 4.

Table 4. Fatty acid composition (g/100 fatty acids) of the subcutaneous fat (outer and inner layers) from Iberian x Duroc pigs finished in confinement with formulated diets

Fatty acid	Dietary fat†			Pooled SEM
	Mono	Medium	Poly	
Outer layer				
C16:0	22.31	23.75	23.40	1.78
C18:0	13.71	14.59	14.18	1.16
C18:1 n-9	44.40[a]	41.58[b]	41.41[b]	2.27
C18:2 n-6	8.83[a]	9.07[a]	10.59[b]	0.88
Σ SFA††	37.62	40.09	39.29	2.66
Σ MUFA††	52.55[a]	49.51[b]	49.02[b]	2.49
Σ PUFA††	10.63[a]	11.47[ab]	12.51[b]	1.03
Inner layer				
C16:0	25.53	26.16	25.51	1.30
C18:0	15.59[a]	17.60[b]	17.52[b]	1.30
C18:1 n-9	41.70[a]	39.16[b]	39.14[b]	1.68
C18:2 n-6	7.81[a]	8.09[a]	9.19[b]	0.58
Σ SFA††	42.78	45.45	44.67	2.10
Σ MUFA††	48.06[a]	45.06[b]	44.69[b]	1.81
Σ PUFA††	9.19[a]	9.52[a]	10.64[b]	0.66

†Mono, medium and poly diets contained a 4% of added fat. The mixed diets contained the same concentration of saturated and linolenic fatty acids. Mono: 1.54% Iberian pig lard + 2.64% olive oil oleine (21 g of C18:1 n-9/100 g fatty acid) Medium: 1.87% Iberian pig lard + 0.9% sunflower oil oleine + 1.23% olive oil oleine (16 g of C18:1 n-9/100 g fatty acid) Poly: 2.20% Iberian pig lard + 1.80% sunflower oil oleine (14 g of C18:1 n-9/100 g fatty acid).
††Σ SFA, Σ MUFA, Σ PUFA = sum all saturate (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids, respectively.
[a,b]Within row, means with different superscripts are significantly different $P < 0.05$.
Source: Daza *et al.* (2005b).

Supplementation of feeding with copper may decrease the proportion of saturated fatty acids and increase that of MUFA. In fact, supplementation with only 35 mg of copper per kg of feed was enough to modify the fatty acid profile of hepatic tissue from Iberian pigs fed in confinement with mixed diets. The concentration of lauric (C14:0), palmitic (C16:0) and margaric (C17:0) acids in neutral lipids decreased and that of oleic acid and unsaturation index increased, although the latter two effects were not significant (López-Bote and Rey, 2001).

These feeding strategies are promising for the Iberian pig sector as a whole, since are aimed not only to improve the profitability of farmers, but also the technological quality (industrials) and the sensory, nutritional and health features of the product (consumers).

The use of biological (both animal and vegetal), labor, technical and financial resources have experienced notable changes in the last 50 years. The traditional free range system for rearing Iberian pigs, which has nowadays almost disappeared, was characterized by:

(i) The use of pure Iberian breed.

(ii) Reproductive plans involve farrowing during May-June and November-December for adult sows, and during February-March for gilts born in November-December. Non-pregnant sows mated in summer, and that consequently will not deliver in November-December, will mate again during autumn, together with the gilts. Those sows delivering in February-March will mate again in May-June.

(iii) Weaning of piglets at 8-9 weeks of age.

(iv) Feeding of reproductive animals based in the available sources of the "Dehesa" and supplemented with mixed diets during the last month of pregnancy and lactation. According to Benito *et al.* (1986), the free range feeding of Iberian sows in the "Dehesa" allows in saving close to 30% of energetic needs for gestation and 20% for lactation.

(v) Birth in open pens, which led to a high rate of mortality in piglets due to crushing.

(vi) Free rearing of pigs during the "recria" and "recebo" phases, in farmyards with feeding supplementation (1.5-2.5 kg/day) and finishing in "montanera", with an animal density of 0.6-0.7 pigs/ha. Also "recria" and "recebo" phases in montanera and finishing with mixed diets.

In recent years, the Iberian pig meat industry has developed considerably, with the incorporation of modern production and processing techniques. Modern technologies of feeding and management are now commonplaces, in some cases combined with traditional practices. Of course quality characteristics of meat products are not comparable to those obtained from pigs raised extensively, probably due to the effect of feeding, exercise, temperature, etc., but they are still meat products of high quality. uality control measures have been implemented to avoid fraud in the marketing. At the moment the main struggle in this sector is to preserve the quality attributes of the traditional systems and establish controls that avoid fakes practices, thus allowing the farmers that produce according to the traditional way to obtain a higher income for their pigs than those using alternative production systems (other breeds, production in confinement, etc.).

At the moment, the Official uality Norm establishes (despite the reluctance of some important members of the Iberian swine industry, such as dry cured ham processors) that the sows should be pure Iberian breed, allowing the boar to be either pure Duroc or crossbreed Duroc x Iberian. Nevertheless, some farmers claim that prohibiting the use of pure Duroc or Duroc x Iberian sows could be an economical drawback for Iberian pig farms, due to a significant decrease in productive traits.

The traditional production of meat products from Iberian pigs has very little in common with that of meat products obtained from selected pigs raised under intensive conditions, and it constitutes an example of the preparation of high quality meat products, comparable to the most exquisite food products in the world. The production of Iberian pig is deeply bound to the Mediterranean ecosystem. It is a rare example in the world swine production where the pig contributes so decisively to the preservation of the ecosystem.

The future of Iberian swine sector is promising. The extraordinarily social prestige of Iberian meat products, the progressive increase of consumers income (which stimulates consume of highly rated products), the notable effort carried out in the organisation of the productive sector and in the homogenization, typifying, traceability and hygienic trustfulness of the derived meat products, and the exportation to countries of the European Union, and to America and Japan, could be exponents of such future. This has to be based in strict quality control of the entire process of production, processing and commercialization.

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Performance at slaughter and beef quality characteristics of some Mediterranean beef breeds compared to Central and North European breeds (GemQual EU Project)

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SUMMARY – This work is part of a European Project called GemQual (Genetics of Meat Quality), which aims to define genetic components of meat quality, taking into consideration measurements on different European breeds. In Europe, consumers show different preferences regarding beef quality characteristics in accordance with geographical areas. The study of these quality characteristics is therefore of importance. Young bulls were reared and slaughtered in 5 countries by the GemQual partners using standardized protocols. In this paper, only performance and quality meat data of beef cattle subdivided in two groups are presented. The first group corresponds to Mediterranean breeds (Med: Asturiana de los Valles, Charolais, Limousin, Marchigiana, Piemontese and Pirenaica) and the second group to North European breeds (NorthE: Aberdeen Angus, Simmental and South Devon). The fatness score was lower in the Med animals ("2+" vs "3") particularly for the double muscle animals ("1+"). The less fatty animals showed on the contrary a higher meat percentage (+7.3%). Med group showed a good lightness (44.02 vs 40.25) and higher values of redness and yellowness of their meat (15.62 vs 12.22, 15.13 vs 12.71 respectively). Total pigments showed higher value for Med group (approximately +4%), particularly due to oxymyoglobin content significantly higher compared to NorthE group (+2.1%). In conclusion, quality meat appears different between groups, Mediterranean breeds being characterized by a lower fat percentage in the carcass and a light meat.

Key words: Beef, meat quality, breed, carcass.

RESUME – "Performances à l'abattage et caractéristiques de la viande de quelques races bovines méditerranéennes par rapport aux races du Centre et de l'Est de l'Europe (Projet UE GemQual) ". Ce travail s'inscrit dans le cadre d'un projet européen intitulé GemQual (Génétique de la Qualité de la Viande), dont l'objectif est d'étudier le déterminisme génétique de la qualité de la viande bovine à partir de mesures sur différentes races bovines européennes. En Europe, les consommateurs manifestent des préférences concernant les caractéristiques de la qualité de la viande bovine en fonction des régions géographiques. L'étude de ces critères de qualité est donc de toute première importance. Des taurillons ont été élevés et abattus dans 5 pays par les différents partenaires du projet GemQual selon des protocoles standardisés. Dans cet article, seules les performances zootechniques et les données de qualité de viande de deux groupes de races bovines seront rapportées. Le premier groupe correspond aux races bovines méditerranéennes (Med : Asturiana de los Valles, Charolais, Limousin, Marchigiana, Piemontese et Pirenaica) et le second aux races bovines du Nord de l'Europe (NorthE : Aberdeen Angus, Simmental et South Devon). L'état d'engraissement est plus faible pour les races du groupe Med ("2+" vs "3") en particulier pour les animaux "culards" ("1+"). Les animaux les moins gras ont au contraire les valeurs de rendement en viande les plus élevées (+7,3%). La viande du groupe Med est claire (44,02 vs 40,25) et avec des valeurs de rouge et de jaune plus élevées (15,62 vs 12,22, 15,13 vs 12,71 respectivement). Les teneurs en pigments totaux dans la viande sont plus élevées pour le groupe Med (environ

4), en particulier en raison de teneurs en oxymyoglobine élevées par rapport au groupe NorthE (2,1). En conclusion, la qualité de la viande est différente entre les deux groupes de races bovines étudiés, les races méditerranéennes produisant des carcasses maigres et une viande claire.

Mots-clés : *Bovin, qualité de la viande, race, carcasse.*

Introduction

This work is part of a European Project named Gem ual (Genetics of Meat uality), which aims to define genetic component of meat quality, taking into consideration measurements on different European breeds, and also evaluating candidate genes influence on pointed out variations.

Basic research goals were:

(i) To determine possible differences in genetic component as to relate them with meat quality variation of different breeds reared in comparable conditions.

(ii) To identify loci and single nucleotide polymorphisms (SNPs) of candidate genes which could influence meat quality.

(iii) To test and select candidate genes for their influence on meat quality variation.

Analysis of meat quality aimed to detect differences among breeds reared in each European country, taking into account meat quality aspects that are considered important by consumers. Another objective of the project (not reported in the present paper) was to look for associations between gene polymorphisms and quality characteristics.

Five European States (Denmark, France, Italy, Spain and United Kingdom) were involved in the present research. The most representative breeds for each country were chosen reaching a total of fifteen beef or milk specialized breeds and/or local breeds.

The reported results concern only the following European beef breeds: Aberdeen Angus, Asturiana de los Valles, Charolais, Limousin, Marchigiana, Piemontese, Pirenaica, Simmental and South Devon.

Among them, Piemontese, Asturiana de los Valles, Charolais, Limousin and Aberdeen Angus are high specialised breeds the first two bearing the muscular double muscle character and being very lean, particularly Piemontese breed. The Charolais and the Limousin have an excellent development in the back of the body, while Aberdeen Angus is characterized by a greater intramuscular fat amount despite the good muscular development.

South Devon and Simmental are milk/beef double purpose with a higher tendency to meat production on the contrary Marchigiana and Pirenaica originally draught breeds, nowadays are reared for beef. These breeds show lower dressing percentage in comparison with the previous ones but have good productive characteristics.

The influence of breed on beef quality has been analyzed and compared in a lot of studies (Crouse *et al.*, 1989 Whipple *et al.*, 1990 Destefanis *et al.*, 1996 Wulf *et al.*, 1997), but this study is among the first which analyses so many different breeds in the same experiment.

In Europe consumers show different preferences regarding the quality characteristics in accordance with geographical areas as underlined by Sañudo *et al*. (1998). In fact, in the Mediterranean area, consumers prefer young animals slaughtered between 12 and 24 months of age with lean and clear meat (Monsón *et al.*, 2005) unlike British traditional beef (Lawrie, 1979).

The aim of this paper is to compare some carcass characteristics and meat quality parameters between breeds reared in North Europe and some others reared in Mediterranean areas to underline the differences between these two groups of breeds.

Materials and methods

In this paper, the data of 258 young bulls subdivided in two groups were studied: Asturiana de los Valles (AV), Charolais (CH), Limousin (LI), Marchigiana (MG), Piemontese (PD) and Pirenaica (PI) which were considered as Mediterranean breeds (Med) and Aberdeen Angus (AA), Simmental (SM) and South Devon (SD) which were meant as North European breeds (NorthE).

The animals were reared and slaughtered in 5 countries by the Gem ual partners using standardized rearing systems and slaughtering protocols, so that quality characteristics were evaluated using standardized procedures.

Each country has carried out specific measurements on all samples, which were frozen and transported in the proper way.

At the age of about 8-9 months, all animals were included in the experimental test and recovered in multiple boxes with 7-8 heads for group, using intensive rearing system. Whole rearing period s diet consisted mostly of concentrates, barley 82% and soybean 8%, with 7.5% of straw which brought the requisite integration of long fibre in addition animals were fed on a mineral vitamin integrator and bicarbonate, in order to avoid rumen acidosis due to the large part of concentrates in the diet, (Sañudo *et al*., 2004). Since the above mentioned countries didn t produce the same feeds, this diet was chosen to standardize the rearing techniques.

The animals were slaughtered at about 15 months of age, or rather when they had reached 75% of an adult beef s standard weight, with an average live weight showed in details in Table 1.

Table 1. Average live weight and slaughtering age values per breed

Breed	Weight (kg)	Age (d)
Aberdeen Angus	597.7 25.1 bcd	428.6 48.0 bc
Asturiana de los Valles	557.7 48.5 ef	460.6 30.4 a
Charolais	634.0 40.0 a	460.6 21.6 a
Limousin	565.4 30.3 ed	428.0 22.8 bc
Marchigiana	523.5 38.0 g	459.2 19.4 a
Piemontese	527.3 40.1 g	461.0 19.0 ab
Pirenaica	602.4 52.7 abc	444.8 32.3 ab
Simmental	621.8 93.3 ab	455.9 10.8 a
South Devon	591.7 32.5 bcd	398.5 46.9 d

a, b, c, d, e, f, g: Significant differences between breeds ($p<0.05$).

The North European breeds have the final live weight above the mean together with Pirenaica and Charolais Mediterranean breeds (Table 1) while the other Mediterranean breeds are below the mean.

The final age is 427.7 days for the North European breeds and 452.4 days for the Mediterranean ones.

Young bull cattle were slaughtered in EEC label abattoirs following only one experimental protocol for all the breeds. Before slaughtering, animals were kept for about 12 hours without feed.

The following research institutes performed rearing and slaughtering: Roslin Institute, Scotland Den Kongelige Veter n og Landboh jskol, Frederiksberg Denmark Centro de Investigación y Tecnolog a Agroalimentaria de Aragón, Spain CRA - Istituto Sperimentale per la Zootecnia, Italy Institut National de la Recherche Agronomique (Theix), France.

After slaughter, carcasses were divided in two half sides which were stored in a cold room at 2°C for ageing. After 3 and 24 hours the pH at the 10th thoracic rib was measured in *Longissimus thoracis* muscle in order to identify DFD carcasses.

The right half side after 24 hours was weighed to calculate dressing percentage and it was also assessed by an expert both for conformation and fatness based on to SEUROP grid the evaluation was converted in 18 classes for conformation and in 15 for fatness degree.

A sample was cut at the 6th thoracic rib and the percentages of meat, bone, fat and other tissues were determined after dissection in order to evaluate tissue composition. On cut between 5th and 6th thoracic rib the *Longissimus* area was evaluated by drawing the perimeter and calculating the area.

The *Longissimus thoracis* muscle was dissected from the frozen half side (between 6th and 13th rib), from which analysis were carried out in two different times: after 48 hours and after 10 days from slaughter. It was established a definite area of this muscle for each analytical measurement as described in Fig. 1, (www.gemqual.com) to minimize variability of the results due to qualitative intramuscular variation.

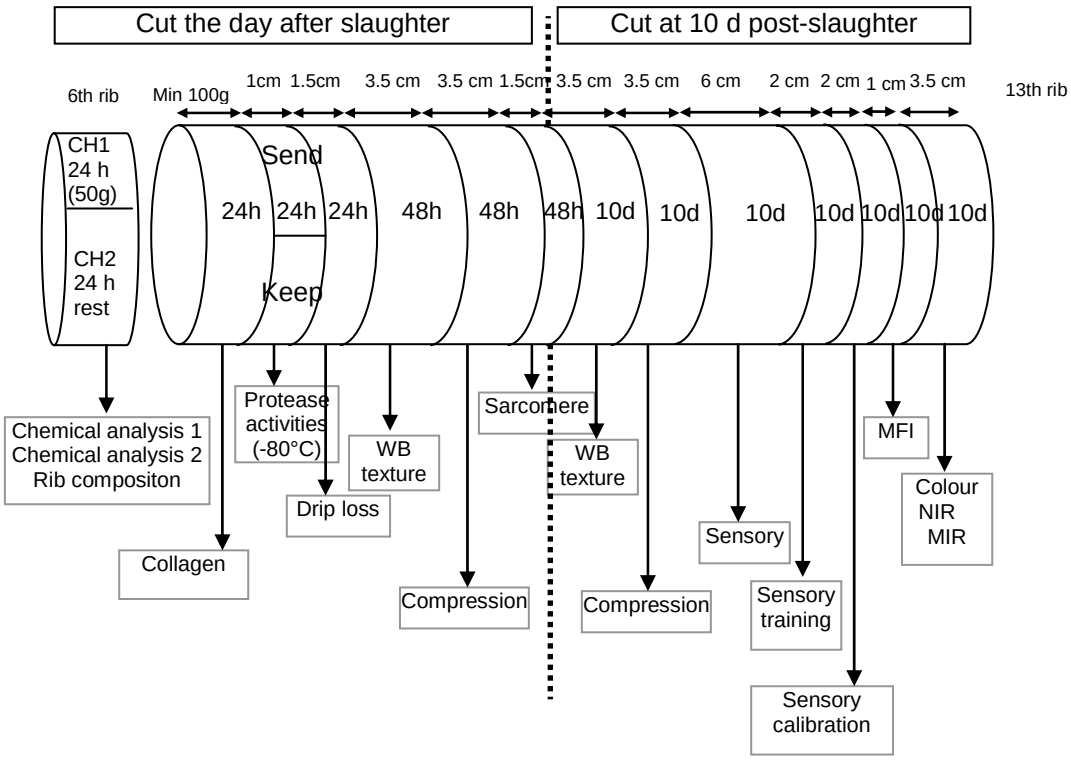

Fig. 1. Sampling of *Longisssimus thoracis.*

Longissimus samples were kept at 4°C until the established day for taking samples and after they were stored vacuum-packed and frozen at -18°C till analysis time.

As far as project analysis protocol was concerned, all physical analyses were considered: texture determination on raw and cooked meat after 10 days ageing, colour and spectrophotometrical analysis to define myoglobinic pigments. In addition, pH at 10 days and drip loss at 24 hours on fresh meat were measured.

Samples were weighed both first and after overnight thawing at 4°C. Thaw loss and pH were estimated to evaluate the freezing process in order to identify sample anomaly or deteriorations. The shear force was carried out with the Warner Bratzler Shear (WBS) on an Instron 1011 machine. The test was made both on raw sample at 10 days of ageing and on cooked sample ageing 48 hours and 10 days.

Shear force was measured on raw and cooked meat. Samples were cooked in a water bath at 80°C to an internal temperature of 78°C, then cooled in running tap water for 45 and stored in a refrigerator for 4 hours. Cooking losses were later calculated as percentage.

On ten samples, 1 cm^2 of cross section, with fibre direction paralleled to length (long axis), maximum load, stress at 20% and at 80%, and also maximum compression were measured with an Instron 4301 machine, using a modified device which avoids transverse elongation of the sample (Campo *et al*., 2000).

The drip loss measurement was made after 24 hours from slaughtering in accordance with Barton-Gade *et al.* (1994).

Colour coordinates were measured at ten points on the surface of slices, 3 cm thick according to Cassens *et al.* (1995). After exposure to air for 1 hour, lightness (L*), redness (a*), yellowness (b*), chroma (C) and hue (H) were calculated with CIEL*a*b* System using D65 illuminant and using spectrophotometer Minolta CM-2600d reflectance spectra between 360 and 740 nm (by steps of 10 nm) was also measured.

The ratio between absorption and dispersion (K/S) was calculated using meat reflectance values, in accordance with the following formula:

$K/S = (1-R)^2/2R$

R = reflectance at different wavelengths.

Different fragments of myoglobin were measured from K/S according the AMSA (1991) formulas using isosbestic points of oxymyoglobin and metmyoglobin.

DeMb (%) = (K/S 474 nm) / (K/S 525 nm)
MetMb (%) = (K/S 572 nm) / (K/S 525 nm)
OxyMb (%) = (K/S 610 nm) / (K/S 525 nm).

pH was evaluated from the average of 4 surveys at the 10th thoracic rib, with a pHmeter with temperature compensation.

The statistic analysis of variance was performed on GLM procedure of SAS software (SAS, 1985) using a monofactorial model:

$Y = M + A_{j+} E_{jk}$
M = average
A_j = breed group type effect (j = 1,2)
E_{jk} = error

To evaluate relationships among the groups and variables, the principal component analysis was performed on standardized data, using Princomp procedure of SAS software.

Results and discussion

The live weight of the two groups showed remarkable differences (Table 2). In fact although NorthE animals were younger than the Med ones of about 24 days, they had a live weight exceeding 33.8 kg. The best performances of NorthE group were evidenced also from the elevated average daily gain (ADG), principally due to Aberdeen Angus and South Devon breeds that showed a growth compensation gain, recorded during the first experimental period (Albert *et al*., 2006, in press). During the last period of breeding (from 12 months to slaughter), ADG was indeed lower, namely 1.51 kg for South Devon and 1.3 kg for the Aberdeen Angus as reported in the same paper.

However the double-muscled animals (Piemontese and Asturiana de los Valles) showed a lower live weight (542.5 kg) than the other animals specialized for meat production as Charolais and Limousin for Med group (599.1 kg on average) and Aberdeen Angus for NorthE group (597.6 kg).

The carcass weight of Mediterranean animals was approximately 11 kg greater than that of the others, because of a better dressing percentage (61.9 *vs* 56.9%). The higher value in the first group of animals was due mainly to the double-muscled breeds, in fact Piemontese and Asturiana de los Valles which showed 63.11% of dressing percentage as reported in other works (Albert *et al*., 1998 Lazzaroni *et al.*, 1999). However, excluding these two breeds, animals of Mediterranean origin still showed a better dressing percentage (+3.4%). The Med group showed also good conformation score

("U+" vs "U-"), this difference depending almost exclusively on double-muscled animals (13.33, "E-" on average). In fact, without these two genotypes, the conformation scores were similar between the two groups of breeds (10.65 vs 9.83).

Table 2. Performances at slaughter

Groups	Live weight (kg)	Carcass weight (kg)	ADG (kg/d)	Dressing percentage (%)	Conformation score	Fatness score
Med	569.1 b	352.4 a	1.35 b	61.94 a	11.5 a	5.8 b
NorthE	601.9 a	341.9 b	1.80 a	56.86 b	9.8 b	8.1 a
Means	578.9	349.2	1.49	60.42	11.0	6.5
sd	56.3	36.1	0.26	2.95	2.3	2.6

a, b: Significant differences bteween breeds ($p<0.05$)

The fatness score was lower in the Med animals (5.8 vs 8.1, Table 2, class "2+" vs "3") particularly for the double-muscled animals (3.83, class "1+"), while the two French breeds showed similar values than NorthE breeds (8.69 vs 8.14 about class "3"); the other animals (Pirenaica and Marchigiana) had intermediate values (4.94, class "2" on average for the two genotypes).

Tissue composition (Fig. 2), estimated by the dissection of the rib samples emphasized fat accumulation for NorthE animals (16.44 vs 9.73%) in particular if compared to double-muscled animals (5.50%), while the difference with French animals was limited (+2.2%).

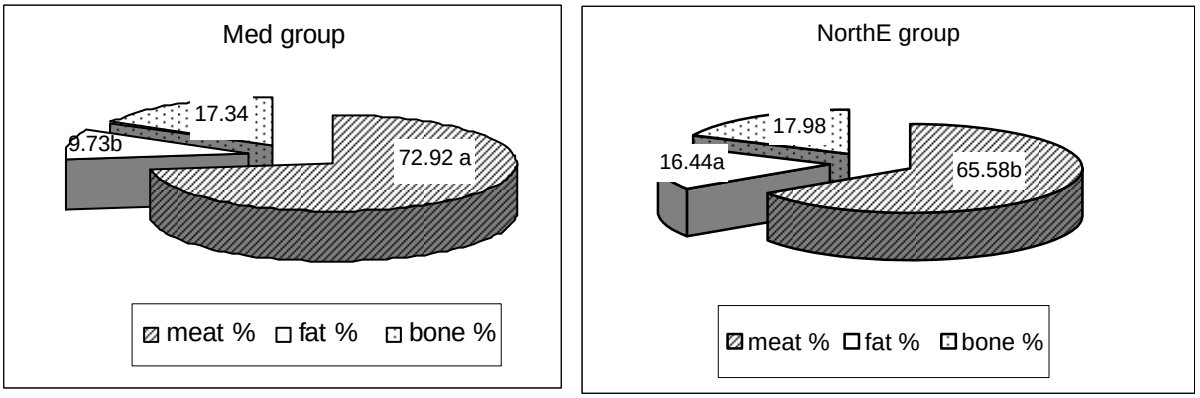

Fig. 2. Tissue composition percentage.

The leaner animals showed an elevated meat percentage (72.92 vs 65.58%, Fig. 2) being the bone percentage similar in both groups (17.66% in average). Generally Spanish and Italian breeds (double-muscled or not) showed a greater proportion of lean tissue, while the French breeds were similar to NorthE breeds (69.8 vs 65.58%). Moreover, the different productive performances between two groups didn't depend on different slaughter weights: using a covariate analysis with slaughter weight as covariate, the differences between breeds remained indeed substantially unchanged.

The Longissimus thoracis pH (Table 3) was similar at 24 hours but showed different values at 10 days of ageing between the two groups, marbling in NorthE group determined probably a limited increase of pH (Lawrie et al., 1974). In fact, pH was positively correlated with fat percentage ($r = 0.18$; $P < 0.01$) and negatively with meat amount ($r = –0.22$; $P < 0.001$), while it didn't show any correlation with texture values. Therefore, pH difference did not seem to be linked to muscle proteolysis, also because the differences between groups for drip loss and thaw loss were not significant, while cooking loss in NorthE animals was higher (+1.5%), due to intramuscular fat cooking mobility.

Both raw and cooked meat of NorthE animals (Table 4) were tougher than meat from Med animals

(40.56 *vs* 44.97 N 53.10 *vs* 60.00 N respectively), although the maximum load and stress at 20% (that estimates myofibrillar break) were similar (Lepetit and Culioli, 1994), while stress at 80% in NorthE group was higher. Double-muscled animals showed lower shear force on raw meat, maximum load and stress at 20% and at 80% (37.08, 3.99, 30.20 respectively for WBS raw, stress 20% and stress 80%), although some authors reported that these animals had tough myofibres (Clinquart *et al.*, 1998).

Table 3. pH and water loss at different times

Groups	pH at 24 h	pH at 10 days	Drip loss 24 hours (%)	Thaw loss % at 10 days	Cooking loss % at 10 days
Med	5.64	5.54 b	2.98	7.34	25.56 b
NorthE	5.65	5.61 a	2.57	6.93	27.09 a
Means	5.64	5.56	2.86	7.22	26.01
sd	0.174	0.09	1.68	1.86	2.23

a, b: Significant differences between breeds ($p<0.05$).

Table 4. Texture determination on raw and cooked meat at 10 days (N)

Groups	WBS raw	WBS cooked	Max laod	Stress 20%	Stress 80%
Med	40.56 b	53.10 b	52.05	4.27	35.41 b
NorthE	44.97 a	60.00 a	55.23	4.51	38.29 a
Means	41.88	55.09	53.00	4.34	36.27
sd	9.91	11.90	13.00	1.22	8.76

a, b: Significant differences between breeds ($p<0.05$).

Generally, the genetic type has an influence on shear force on cooked meat. In particular it was noticed that Simmental breed showed tougher meat. On the opposite, it was showed that double-muscled animals had a more tender raw meat (Lazzaroni *et al.,* 1994 Campo *et al.,* 2000 de Smet *et al.*, 1998 Sarti *et al.*, 2005), which became during cooking stringy because this meat is poor of fat and losses a lot of water, increasing shrinkage during cooking (Seideman *et al.*, 1987).

All texture values were correlated with cooking loss (especially maximum load $r = 0.33$, $P < 0.001$), confirming the more water losses the tougher meat became (Silva *et al*., 1999).

Med group (Table 5) evidenced a good lightness and higher values of redness and yellowness, Chroma (+23, 2%) and Hue (-4, 8%), that means a colour more near to ideal red with a good intensity.

Table 5. Colour parameters at 10 days

Groups	L*	a*	b*	C	H	Total pigment
Med	44.02 a	15.62 a	15.13 a	21.80 a	44.26 b	4.63 a
NorthE	40.25 b	12.22 b	12.71 b	17.70 b	46.50 a	4.45 b
Means	42.89	14.61	14.41	20.58	44.93	4.57
sd	3.10	2.29	1.36	2.16	4.45	0.27

a, b: Significant differences between breeds ($p<0.05$).

Low values of lightness have been found by various authors for these breeds (Sami *et al.,* 2004). Among genotypes of the Med group, French breeds, in particular the Charolais, showed a greater lightness (45.67), while a* and b* index were similar to the others breeds. The parameters of colour were negatively correlated with shear force on cooked meat and pH (Wulf *et al.*, 1997), particularly

lightness (r = -0.34, r = -0.31, p<0.001 respectively) and yellowness (r = -0.36, r = -0.37, p<0.001 respectively), while positively correlated with drip loss (r = 0.21, p<0.01 for L and b*). Therefore higher pH and lower drip loss values were significantly associated with lower lightness, higher redness confirming the strong relationship between pH and meat colour.

Total pigments showed higher values for the Med group (about +4%) in particular (Fig. 3) due to oxymyoglobin content significantly higher compared to the NorthE group (+2.1%). Different percentage of oxymyoglobin and metmyoglobin determine the bright or dark coloration of muscle. In fact, Med animals had brighter meat. Within this group, the lower values of oxymyoglobin have been noticed in French breeds, in particular for Limousin (57.22%), the higher value being observed for Asturiana (60.13%). Metmyoglobin instead was higher in NorthE group, especially for South Devon breed (19.05%). Apart from colour parameters (L*, a* and b*), these pigments were also correlated with thaw loss, in fact excessive water loss was positively correlated with metmyoglobin (r = 0.22, p<0.01) and negatively with oxymyoglobin (r = -0.25, p<0.001), indicating the conservation state between the two pigments.

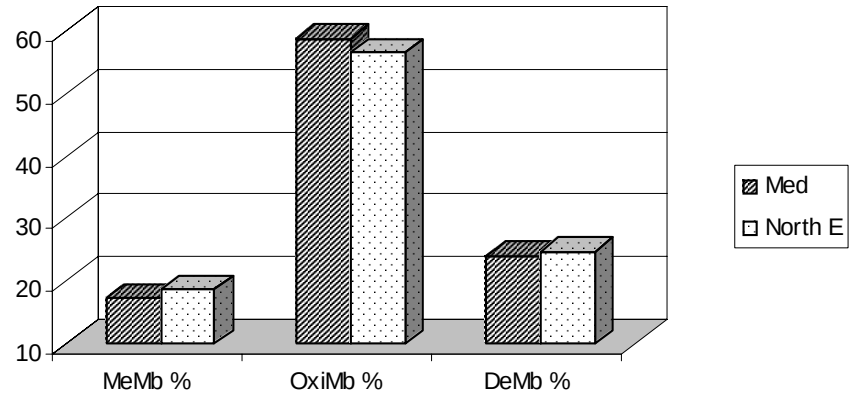

Fig. 3. Percentage composition of pigment.

The 1st and 2nd principal components (Fig. 4) explained about the 70% of the variability, particularly myoglobin pigments and meat colour explained the principal differences between the two groups of breeds. Analyzing altogether qualitative parameters, the meat colour was opposed to pH and toughness. Med and NorthE groups were divided in two separate areas even if not clearly. In fact same parameters of French breed appeared similar to NorthE.

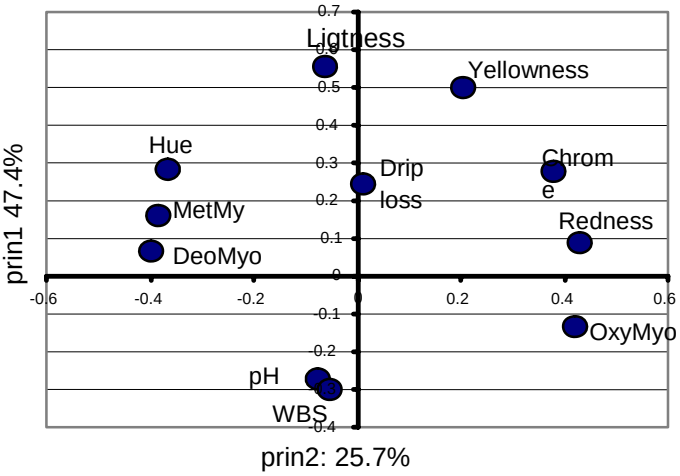

Fig. 4. Principal component analysis: projection of variables.

The NorthE group was characterized by a greater toughness and a low lightness (Fig. 5), while a light lightness was a characteristics of the Med group together with redness and yellowness.

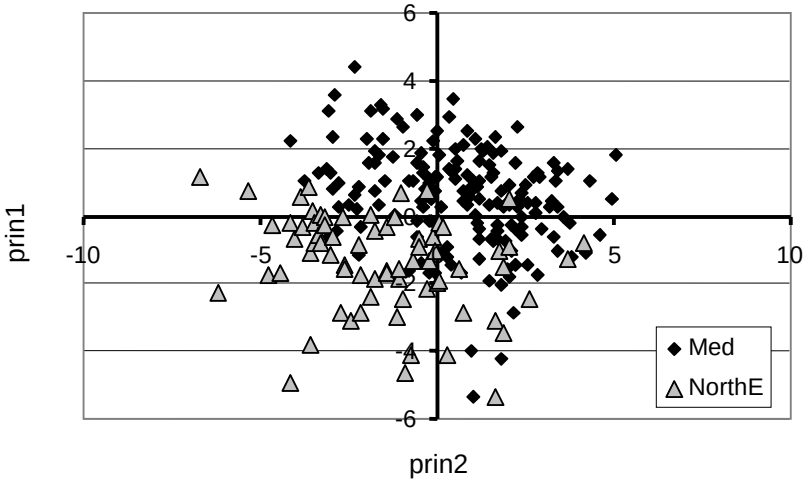

Fig. 5. Principal component analysis: projection of individuals and distribution of groups.

Conclusions

Mediterranean breeds were characterized by a lower fat percentage in the carcass and in the meat, and also by a light meat rich in colour pigments. This group showed a more tender meat even if the differences became small in compression tests thanks to high marbling. Obviously, pH and water loss variability pointed out the different muscle biochemical characteristics.

However, it has to be underlined that North European consumers tastes are very different than that of the Mediterranean s ones: the former prefer a marbled meat, mostly obtained from castrated animals while the latter would prefer a lean and light meat obtained from younger animals.

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Cabri de Corse :
Questions préalables à une démarche de certification

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RESUME – Le cabri de Corse, viande de lait consommée traditionnellement pour les fêtes de Noël, demeure une part importante du revenu de l'éleveur. Les éleveurs s'interrogent sur l'avenir de cette production aujourd'hui menacée par les évolutions de la consommation et de la réglementation. Certains d'entre eux souhaitent s'engager dans une démarche de certification qui nécessite pour la Recherche un certain nombre de conditions préalables : clarification des objectifs, identification des acteurs concernés, points critiques à maîtriser.

Mots-clés : Cabri de Corse, certification, abattage, réglementation.

SUMMARY – "Kid of Corsica: Questions previous to the certification process". The milk kid of Corsica consumed traditionally for Christmas remains a significant part of the income of the goat breeders. The breeders wonder about the future of this production now threatened by the evolutions of consumption and the regulation. Some of them wish to engage a process of certification which require a certain number of preconditions for Research: clarification of objectives, identification of the actors concerned, critical points to be managed.

Key words: Kid of Corsica, certification, slaughter, regulation.

En Corse, l'élevage des petits ruminants laitiers reste une activité conséquente de l'agriculture de l'intérieur montagneux de l'île. L'élevage caprin, avec environ 30 000 têtes, permet de valoriser ce type de milieu contraint à partir d'une race locale (Capra Corsa) et de systèmes d'élevage dits "traditionnels". Ces systèmes, dont il est culturellement acquis qu'ils sont basés sur des pratiques et des savoirs faire ancestraux, se sont en réalité graduellement adaptés à l'évolution socio-économique de la société insulaire (Bouche et al., 2004).

La chèvre corse, réputée pour son aptitude au désaisonnement, met traditionnellement bas début novembre (80% des femelles), ce qui permet la production de cabris de lait consommés pour les fêtes de Noël. En cette période, ce produit patrimonial à fort ancrage culturel[1] est très bien valorisé. Elevé sous la mère selon des savoir-faire anciens, c'est une viande dont la typicité est reconnue et particulièrement appréciée. Or, avec une forte diminution des effectifs caprins, le cabri est devenu un produit dit "de luxe", dont l'offre ne suffit pas à répondre à la demande. Rareté et traditions culinaires font que le cabri est aujourd'hui vendu à des prix parfois très élevés (jusqu'à 15 € le kg payé à l'éleveur). Ainsi, si la production principale de l'élevage caprin reste orientée vers la transformation fromagère, la vente des cabris de Noël peut représenter jusqu'à un tiers du revenu de l'éleveur (Bordeaux, 2004).

Le cabri de Noël constitue donc une spéculation attractive qui risque d'inciter à l'importation ou aux contrefaçons. Pour exemple, il n'est plus rare désormais que les chevreaux du continent, nourris au lait artificiel dans des structures d'engraissement, apparaissent dans les linéaires des grandes surfaces locales, ce qui inquiète les éleveurs insulaires.

Afin de protéger ce produit patrimonial contre l'importation et les dénominations abusives, un collectif d'éleveurs, représenté par un syndicat professionnel dénommé Capra Corsa, se pose la question de sa certification.

Interpellés sur cette question, et afin d'éclairer cette démarche et d'en étudier la faisabilité, les

[1] Tel que le signifie le dicton populaire "Agnellu pasquale, caprèttu in Natale" : agneau à Pâques, cabri à la Noël.

chercheurs du LRDE se sont fixés pour objectif d identifier les différents niveaux de contraintes (tant d ordre zootechnique et économique que social ou législatif) et de proposer un mode de traitement des questions de nature nourrir les débats.

Recueil et observation anthropologi ue

Cette étude s est basée sur des enquêtes menées auprès de différents acteurs intéressés, de près ou de loin, par la viande de cabri : des éleveurs, des organismes institutionnels, les Directions des services vétérinaires, l Office du Développement Agricole et Rural de la Corse, les chambres départementales d agricultures, et des intermédiaires économiques (grandes et moyennes surfaces, bouchers, associations de producteurs, restaurateurs, etc.). Elle s est basée par ailleurs sur l observation d abattages fermiers et la visite d abattoirs et de tueries (Débat, 2004). Systématiquement, les enregistrements sonores et vidéo ont été confrontés entre eux et avec les supports écrits issus de ces entretiens. Enfin, la participation l ensemble des réunions de Capra Corsa depuis ces deux dernières années a largement contribué l analyse qui suit.

Les uatre crit res vo ues pour d finir la typicit

D après les enquêtes, la typicité du cabri corse serait dépendante de quatre grands critères :

(i) Une race locale ayant des aptitudes particulières valoriser les territoires de maquis, et dont l alimentation (essentiellement basée sur ces ressources naturelles), la qualité du lait maternel (très riche en matière grasse) ainsi que la croissance des jeunes (faible vitesse de croissance, composition des tissus) donneraient ses particularités la viande.

(ii) Des pratiques spécifiques d élevage des jeunes enfermés dans le "chjostru"[2] durant toute la journée, et parfois même la nuit. Serrés les uns contre les autres, ils s y tiennent chaud et ont des déplacements limités. Le soir, au retour du p turage des mères, chaque cabri est présenté sa mère pour la tétée. Ce mode d élevage semble déterminant pour la croissance des cabris et la qualité des viandes. L alimentation, exclusivement base de lait, permet d obtenir des viandes blanches qui seraient différenciables, dire d éleveurs, selon que l allaitement est maternel ou artificiel.

(iii) Le cabri corse se consommait traditionnellement 35 jours, un poids de carcasse de 5-6 kg. Aujourd hui, ces poids tendent s alourdir aux alentours de 7 ou 9 kg carcasse (50-60 jours).

(iv) L'abattage fermier et la présentation du cabri lors de la vente sont décrits comme critères de spécificité du produit (pieds coupés et antérieurs croisés sur la nuque, présence de la tête, de la fressure, du péritoine utilisé comme un voile sur la carcasse et des tripes).

Comment la typicité, ainsi décrite "culturellement", peut-elle être réellement objectivée ? Sur quels critères, par qui et avec quels moyens de contr le, dès lors o sous une description mystifiée de la tradition pointent, masquées par des pratiques décriées mais rares (lait reconstitué), des évolutions plus diffuses (poids carcasse) pour lesquelles certains semblent s être adaptés de fa on opportuniste ? Par ailleurs, comment les éleveurs envisagent-ils le maintien de pratiques économiquement contraignantes et astreignantes en main d uvre (allaitement maternel) voire prohibées (l abattage fermier) censées donner corps la typicité de leur cabri ?

En eu et points de blocages dans l itin raire de production du cabri corse

Calage des mises bas et faiblesse de trésorerie : un danger pour le renouvellement

En Corse, la campagne d un éleveur caprin est généralement rythmée par deux périodes de reproduction : une mise bas principale d automne (dite "précoce"), et une mise bas de printemps (dite

[2] Chjostru : nom corse (également appelé "sarconu") donné au compartiment clos destiné l enfermement des cabris. Souvent en bois et sur caillebotis.

"tardive"). Du fait de la forte valorisation des cabris en période de No l, la ma trise de la reproduction et les dates de mises bas revêtent une importance particulière dans ces systèmes très extensifs o on peut aujourd hui constater une dégradation tendancielle de la culture technique. Récupération tardive des boucs laissés libres pour l hivernage, dégradation des taux de fertilité et chaleurs tardives sont autant de facteurs qui expliqueraient un retard de plus en plus prononcé des mises bas : 50% contre 80% attendus (Bordeaux, 2004) et qui peuvent avoir des conséquences désastreuses, tant financières que pour la démographie et les performances du cheptel. En effet pour satisfaire la demande de No l, il n est pas rare que les éleveurs sacrifient les chevrettes destinées initialement au renouvellement pour combler une trésorerie exsangue après 5 mois sans revenu.

En quoi une démarche de certification changerait-elle le déficit chronique de l offre, sinon l augmenter par un accroissement de la demande ? N y a t il pas, en préalable engager des moyens susceptibles d améliorer la productivité des troupeaux ?

Allaitement artificiel, une pratique controversée et inavouée

Si traditionnellement les cabris sont élevés sous la mère, la quantité de travail induite par la pratique d allaitement (reconstitution bi-quotidienne des couples mère-cabri, surveillance des tétées, etc.) ainsi que le manque gagner en lait d hiver ont incité certains éleveurs utiliser des distributeurs de lait artificiel. Cette pratique, en plus d avoir certainement des conséquences sur la qualité des viandes consommées, serait totalement néfaste si elle venait s appliquer aux animaux de renouvellement dépendant d un long apprentissage du parcours derrière les mères.

Très peu décrit, sinon en disqualification d un voisin concurrent ou jalousé, l allaitement artificiel semble peu répandu (co t de la poudre de lait, faiblesse des infrastructures pour le chauffage des louves, peur d une baisse de production de la mère par absence d une stimulation naturelle de la tétée, etc.). Peu d éleveurs avouent y avoir recours, et seraient prêts assumer le fait d un étiquetage du cabri élevé de la sorte. A propos de cette pratique mal renseignée sur les aspects économiques et le facteur travail, les avis sont donc partagés entre ceux qui la vantent "avec 40 j à 2 l par bête, je gagnerais plus à faire le fromage", et ceux qui, ostensiblement, y voient parjure, dénaturation des viandes et des traditions. Elle plane plus comme une menace virtuelle alimentant une chimère collective que comme une réalité mettant en danger la filière.

Abattoir, nouveau n ud incontournable

De fa on traditionnelle, le consommateur va chercher son cabri de No l directement chez le producteur. Ce dernier assure lui-même l abattage. L animal est saigné, dépecé, éviscéré, et se présente avec la tête, la fressure et le péritoine (utilisé comme voile protecteur de la carcasse). Avec l Encéphalopathie Spongiforme Bovine, les normes sanitaires se sont durcies interdisant l abattage fermier et la vente directe. Depuis, trois abattoirs furent construits dans l le o néanmoins demeurent encore quelques dérogations pour des tueries particulières. Les circuits courts, sans intermédiaires, semblent voués dispara tre. Dans ce nouveau contexte, nous avons constaté que certains éleveurs étaient satisfaits de déléguer la fonction d "abattage". Fatigue physique et morale, difficulté psychologique liée l acte de tuer sont autant d éléments qui leur rendent confortable l utilisation de ces structures agréées. Or, celles-ci essentiellement con ues pour la filière bovine ne répondent pas aux besoins de la filière caprine. En effet :

(i) Les structures demeurent inaccessibles la majorité des éleveurs, du fait de leur isolement géographique, de la rareté et du co t des équipements obligatoires pour s y rendre (bétaillère) ou récupérer les carcasses (fourgon frigorifique).

(ii) L abattage est principalement calé sur la semaine précédant la fête de No l durant laquelle on estime 12 000, le nombre de têtes abattues sur l le. L abattage du cabri, viande fragile, nécessite des équipements spéciaux et une main d uvre spécialisée. Or, les abattoirs existants n ont pas la capacité traiter un tel volume sur une si courte période, ni n envisagent réellement de faire face ces contraintes particulières en matériel ou en main d uvre. Il arrive qu ils compensent l absence d une main d uvre spécialisée en embauchant les éleveurs eux-mêmes pendant les périodes de pointe. A ce jour moins de 4 000 cabris passent annuellement par les abattoirs. Il est donc évident que l abattage fermier est encore largement pratiqué.

(iii) Stress pré-abattage (transport, conditions d attente d animaux non sevrés), manipulation et stockage "industriels" de la viande sont autant de facteurs détériorateurs de la qualité.

(iv) Enfin, le retrait de la tête et des abats, au-del d une incidence économique (poids) a des conséquences majeures pour une cuisine traditionnelle friande de ces parties (Casabianca, 1996).

Le passage par l abattoir assure incontestablement un niveau de sécurité lié au contr le sanitaire même si le consommateur de proximité conserve ses croyances et demeure parfois difficile convaincre "on a toujours fait ça, il n'y a jamais eu de mort" "sur le porc, il peut y avoir des kystes, mais pas sur le cabri qui ne boit que du lait, c'est sans risque". Il accro t le nombre d intermédiaires et fatalement augmente un prix la consommation déj élevé. Mais surtout, la présentation de la carcasse s en trouve dénaturée ("moi sans le voile, ni la tête, je n'en achète plus"). Paradoxalement, la question du bien être animal, demeure en faveur des tueries particulières, la mise mort est préférée "traditionnelle" ("celui qui sait faire, si le geste est précis avec le couteau, l'animal ne sent rien, quand on dirait qu'il pleure, c'est de l'air mais l'animal est déjà mort"), aux lentes agonies imaginées dans les "couloirs de la mort" des abattoirs, ("les bêtes, elles sentent la mort dès que tu les mets dans le camion", "des fois, il faut attendre une journée sans boire avant qu'elles soient tuées, elles souffrent").

L abattage semble un n ud qu il faudra dénouer préalablement toute démarche. La mise disposition de micro-structures de proximité ou mobiles contr lées par les services vétérinaires et gérées par les d éleveurs caprins a souvent été avancée. Est-elle envisageable ?

Vente : confiance domestique et griffe d éleveurs

Actuellement, il n existe aucune organisation du marché, et peu de lisibilité sur les circuits existants et les volumes écoulés. Différents scénarios et acteurs ont été identifiés mais demeurent quantitativement peu précis.

Dans la vente directe, la transaction "domestique" est basée sur une confiance (Casabianca et al., 1994) et sur la reconnaissance du savoir-faire de l éleveur. L absence d intermédiaire permet un prix intéressant pour les deux parties. De plus, dans la société insulaire, acheter son cabri chez l éleveur revêt une dimension symbolique forte, au-del de participer une économie solidaire, elle demeure connotée d une attache aux racines ("on a tous eu un aïeul berger"). Supprimer la vente directe, n est-ce pas mettre en péril l avenir du cabri de No l, dont l achat en grande surface ne possède plus la même symbolique ?

Lorsque la vente s effectue par l'intermédiaire d'un boucher ou d un maquignon, le choix et le prix se fait "vif" sur pied et par lot avant la pesée qui tourne rarement l avantage de l éleveur (néanmoins content de se débarrasser du lot en une fois). La confiance et la reconnaissance d une compétence, de même que dans le cas précédent, sont la base de leur relation avec la clientèle.

Lorsque, enfin, le cabri est vendu en grande surface, il est forcément passé par l abattoir et d autres intermédiaires. La dépersonnalisation du produit, qui n est plus associé un savoir faire spécifique et ne se présente plus sous sa forme traditionnelle, nécessite de nouveaux modes de garanties (tra abilité). Une crainte communément partagée par les éleveurs dans cette nouvelle configuration porte sur "l'absence d'une signature", griffe, qu ils s appliquent déposer avec attention durant la finition du produit pour satisfaire le client, "je pose le voile, pour que ce soit propre", "cette entaille derrière le cou, où je glisse les pattes, c'est ma signature, pas besoin d'étiquette". L absence de la tête accro t la confusion ("sans les oreilles, une ménagère peut confondre avec un agneau") et se voit parfois compensée par le maintien du toupet de la queue. Savoir leurs cabris présentés en vrac dans les rayons des GSM, proximité de ceux "qui viennent des congélateurs du continent" ou "à côté d'une dinde de Noël" inquiète particulièrement les éleveurs.

Selon le circuit emprunté, la qualité, le bien être animal et les prix (producteur et consommateur) varient fortement. Ces derniers fluctuent actuellement du simple au double selon les régions, les périodes de vente (hors période de No l), les débouchés voire les éleveurs eux-mêmes.

Dans la perspective d une organisation du marché, il sera nécessaire de clarifier et d anticiper les

flux d animaux. En effet, les producteurs, s ils veulent négocier collectivement des prix soutenus auprès de la grande distribution devenue incontournable, devront être capables de planifier des quantités de cabris fournir pour des dates précises, et de se coordonner entre eux. Enfin, les éleveurs devront harmoniser leurs tarifs et, afin notamment de répondre aux critères de qualité commerciale, nécessairement définir les fourchettes de poids et d ge l abattage.

oint de vue des acteurs concernant la certification du cabri

Les acteurs concernés par la production du cabri sont éleveurs, bouchers, maquignons, grossistes, chefs de rayon de grandes et moyennes surfaces, restaurateurs et consommateurs. Nous avons constaté par ailleurs l importance des administrations chargées d appliquer la réglementation européenne sanitaire, mais aussi celle des syndicats professionnels d autres espèces (notamment bovine) qui ont fortement conditionné le format des abattoirs. Des acteurs qui représentent autant de postures différentes concernant la production du cabri et la mise en place d une certification. Si, durant les enquêtes, la certification était systématiquement abordée avec enthousiasme, l analyse des discours montre que tous les acteurs ne sont pas favorables cette démarche.

(i) Les administrations se sentent peu concernées, mais sont très favorables toute démarche "organisatrice" favorisant un passage par l abattoir, et la tra abilité des produits.

(ii) Les GMS sont fortement intéressées par une différenciation du produit l étalage. Cependant, ils émettent des réserves quant des approvisionnements planifiés et réguliers par les éleveurs. Par ailleurs, ils signalent que les consommateurs semblent aujourd hui se détourner du cabri au profit de nouveaux plats festifs (chapon, dinde, etc.).

(iii) Si les bouchers semblent désintéressés par la question, ils s avouent pénalisés par une telle démarche. Ils y voient une concurrence déloyale au profit des grandes surfaces sur la capacité d un "signe" garantir d une qualité, et de fait, dévaloriser leur compétence : "je n'ai pas besoin de la certification. Les clients qui viennent chez moi, ils me font confiance. Je suis capable de leur dire d'où viennent mes produits, la façon dont ils ont été élevés...". Et sans doute aussi une perte de marge de man uvre liée aux exigences de tra abilité et une potentielle structuration de la filière qui rendrait les éleveurs plus même de négocier leurs prix.

(iv) Les éleveurs, quant eux, se divisent en différentes catégories :

- Les réfractaires qui n expriment aucun intérêt pour la certification, car ils écoulent bien leurs cabris, sans difficultés, et des prix raisonnables qu ils ne se voient pas d augmenter (sentiment d abus vis vis de leurs clients). Certains y voient une forme de contr le (cahier des charges).
- Les attentistes ne se sentent pas directement concernés. Si des démarches sont lancées, ils ne veulent pas s engager avant de juger sur les premiers résultats.
- Les motivés se préoccupent largement de l avenir de leur profession, de leur race, et sont soucieux de protéger leur identité. Ils appellent la certification et sont prêts s y investir, sans y voir une plus value financière mais bien la protection de la mention "corse, né et élevé sous la mère".

Nous notons donc un paradoxe entre une demande collective de protection d un bien patrimonial et un désintérêt individuel pour la certification du cabri. N'est-il pas risqué de s'engager sur une démarche de qualification dés lors que les éleveurs ne semblent pas prêts à s'impliquer ?

La certification se h ter lentement sur un chemin u il reste concevoir

Aux vues de ces premiers résultats, si nous identifions un collectif d acteurs regroupé au sein d une association professionnelle désireuse de s orienter vers la certification du cabri, pour autant les motivations au sein de ce groupe peuvent varier. Derrière le terme de "certification" se cachent de nombreuses attentes (protection de l abattage fermier, valorisation des prix hors fête, etc.) et le concept demeure très abstrait pour des éleveurs qui n ont pas encore pris les dimensions d un tel projet. Les divergences d intérêts individuels compromettent la légitimité de ce collectif en tant que porteur du projet de certification.

A l heure actuelle, les objectifs ne sont pas définis clairement et sont encapsulés dans une même "crainte de l'avenir" o se mêlent : dégradation tendancielle de pratiques individuelles (calage de mises bas) ou collectives (entraide pour l abattage), évolution du marché, des modes de distribution et des modes de consommation ou de la réglementation. Une qualité globale alliant tradition, saveur, naturel imaginée comme "atavique" et qu il suffirait de publiciser via une image bucolique pour la rendre indiscutable demeure l idée majoritaire qui annihile les véritables questions engendrées par la qualification comme : la co-conception des critères, les instances et les moyens de contrôle nécessaires pour objectiver cette qualité. Par ailleurs, l élaboration d un compromis autour d un objectif et d un signe distinctif peut entra ner l exclusion de certains et l adhésion de nouveaux intéressés. Or, si un consensus protectionniste contre une institution, un opérateur économique semble possible obtenir au sein de la corporation, la disqualification d un éleveur, voire le contr le de ses pratiques ou l exclusion du projet semble beaucoup plus illusoire.

Si la certification est un outil de valorisation des produits et des filières, elle n est pas identifiée ce jour comme pouvant régler des problèmes de régulation des marchés ou de gestion zootechnique et sanitaire des troupeaux. On peut alors se demander si, en se tournant vers la qualification, les éleveurs trouveront la réponse qu ils attendent. Les problèmes qu ils rencontrent ne sont pas spécifiques la filière caprine corse, et, en se référant des cas semblables, ne peuvent-ils pas trouver de solutions alternatives, plus mêmes de répondre leurs besoins ?

uoiqu il en soit, les professionnels doivent être accompagnés dans cette réflexion par les partenaires du développement. Cela passe par la définition des niveaux de résolution des problèmes, des priorités et des passages obligés d une certification (construction d un cahier des charges, mise en place de systèmes de contr le, etc.), et l apport d éléments de réflexion qui permettraient l avancement de leur projet.

Pour la Recherche, cette demande interroge de fa on générique les questions que posent des productions confidentielles saisonnées pour lesquelles il devra être con u des itinéraires de qualification très spécifiques.

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Pecorino di Lucardo**:**
A sheep s milk cheese historically going back to the Middle Ages produced during the I century

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SUMMARY – This cheese is obtained from raw sheep s milk and vegetable rennet its production goes back to the Middle Ages and was lost after this period. A study, concerning sanitary hygiene aspects of its production and transformation, involved four agro-pastoral farms in the provinces of Florence and Siena, the original production area of the *Pecorino di Lucardo*, in the project of retrieval, i.e. producing the cheese directly from the milk following ancient recipes recovered from historical sources. Production techniques take advantage of the derogations predicted by the European Hygiene Regulations but the study shows that the reality of current production structures and sheep holdings as well as the quality of the milk produced differ from the reality of 400 years ago. The crises concerning milk production lead producers to rediscover traditional cheeses of quality and to introduce them to the market. This requires the ability to know how much of the tradition may be retrieved and adapted to modern systems of farming and transformation in order to produce quality cheese on a medium scale.

Key words: *Pecorino di Lucardo*, traditional cheese, hygiene.

***R SUM* –** *"*Pecorino di Lucardo*: Un fromage au lait de brebis qui remonte historiquement au Moyen Age, produit au XXI^e^ siècle". Le fromage est obtenu avec du lait cru de brebis et de la présure de légumes. Sa production remonte au Moyen Age et fut interrompue après cette période. Une étude, concernant l aspect d hygiène sanitaire de sa production et transformation, impliquait 4 fermes agropastorales des provinces de Florence et de Sienne, la région de production originelle du* Pecorino di Lucardo*, dans un projet de redécouverte, c est à dire la fabrication en suivant directement les recettes recouvrées par des sources historiques. Les techniques de production profitent des dérogations accordées par les normes d hygiène européennes mais l étude démontre que les réalités des structures actuelles de production et d élevage des moutons aussi bien que la qualité du lait produit diffèrent des réalités d il y a 400 ans. Les crises concernant la production du lait conduisent les producteurs à redécouvrir des fromages traditionnels de qualité et à les introduire sur le marché. Ceci nécessite la capacité de savoir extraire le meilleur de la tradition et de l adapter aux systèmes d élevage et de transformation modernes dans le but de produire des fromages de qualité à une échelle moyenne.*

Mo s s : Pecorino di Lucardo*, fromage traditionnel, hygiène.*

Introduction

An historic inquiry has brought back to our present times a forgotten cheese that was however recognized and appreciated since the VIII century in Italy due to its higher selling price in comparison to other cheeses produced in Tuscany during the same period: the *Pecorino di Lucardo* or *Mar olino di Lucardo*. The name of this cheese explains the period of production (March – spring time) as well as the origin of production (Lucardo, a small village in the region of Florence). The production dates back to the Middle Ages but the first proved origins are at the of 1600 when Paolo Borcione from Venice has included this cheese in a memory book of Italian cheese supplying additional information as the milk used is sheep milk and the rennet used is vegetable rennet called thistle (Fig. 1).

This kind of cheese has been produced prevalently by women in Tuscan farms and the ability of producing this cheese has been considered a good quality for marriage.

Fig. 1. The vegetable rennet called thistle.

The production was very limited due to the small number of sheep held in the farm and the period of production: only during spring time.

A precised study of the technique of production has been carried out by a Florentine Doctor called Giovanni Targioni Tozzettini in 1759 due to a case of intoxication in a friary convent where this kind of *Pecorino* cheese has been eaten. This study has been handed on to today and has represented the historic base for the work of recovery.

Materials and methods

A project has been promoted where 4 agro-pastoral farms are participating: 3 in the region of Siena and 1 in the region of Florence. All farms are family conducted and breed sheep of Sardine race. The feeding is mainly based on a daily pasture in a meadow together with an integration of dry fodders during the winter and concentrates bought at the market.

The produced milk is prevalently given to an industrial dairy although all farms have a small dairy within their farms where a part of the milk is turned into cheese and sold at the local market.

As in the past, mostly women are responsible for the production of cheese and the local selling represents an interesting integration of the family s salary although if there exist some law restrictions for milk production.

The 3 farm dairies in the region of Siena are registered according to the EC Directive 92/46 and the one in the region of Florence is authorized according to the national law and foresees the direct selling in the farm or in local markets.

The technique of production for the *Pecorino di Lucardo* has been elaborated according to the historic resources found:

(i) Dry thistle: 4/6 g for 10 litres of milk.

(ii) Temperature for curdling: 38°C.

(iii) Time for curdling: approximate 2 hours.

(iv) Weight per whole cheese: 1-1.1 kg.

(v) Shape of cheese: oval or frustum of cone.

The following transactions are to be effected:

(i) Take away the first milk flower before the forming of the curdling. This flower has to be used

later for re-kneading the curdled mass and spreading it on the surface before placing it into the sackcloth.

(ii) After 2 hours approximately remove finely the curdling in small pieces not bigger than a maize seed.

(iii) After the rest of the mass, it is to be compacted and strained.

(iv) The curdling is to be kneaded with a part of the left first milk flower and the other part is to be spread on the exterior side of the whole cheese. For approximate 20 minutes press the cheese and salt it on the surface.

(v) Place the *Pecorino* cheese in the appropriate line-sackcloth according to the frustum of cone and prick the whole cheese in order to get out the whey.

(vi) Purge the cheese for approximate 2/3 days considering constantly the valuations to be received from operators according to their experience up to the end of the process. If needed a small pressure can be applied (Fig. 2).

(vii) Hang up the whole cheese in a cold store for approximate 2 days after this period the surface of the whole cheese has to oiled with olive oil (Fig. 3).

(viii) Season the cheese in a tuff cellar for a period between 30 and 40 days the cellar has to correspond to the requested temperatures and humidity.

Fig. 2. The *Pecorino di Lucardo* while purging.

Fig. 3. *Pecorino* oiled with olive oil.

Each farm has been controlled following a check list elaborated and validated according to a previous research of industrial dairies. The check list has been created in order to classify each dairy with a specific number that represents a class of hygienic and sanitary risk.

This number is used by the Official Veterinarian Health Service to revoke if necessary the authorization of production or to oblige the farmers to apply the necessary structural or hygienic modifications.

The characteristics of this check list are the following: objectivity, easy to be filled-in, reproduced and repeated, to be used either for small or big dairies/farms.

The check list is divided in 6 sections and different values are attributed to each section: presence and absence from different characteristic and numbers from -2 to +2 where the number 0 is considered as normality.

The sections are the following:

(i) Information about the farm s location and identification.

(ii) Milk quantity produced per year and possible milk collection from other local farms, weekly cheese production (number of days per week), number of employees and possible milk pasteurisation before transformation into cheese.

(iii) Different kind of cheese and derivatives (e.g. cottage cheese).

(iv) Modality of water supplying: public or private aqueduct, water deposit or tank, drink water or water sweetening plants.

(v) Control the whole structure, plant and machines beginning from the milk collection up to the production of cheese and cottage cheese, the seasoning, the storage, the manufacturing as well as hygienic services and water deposit (Fig. 4).

(vi) Verify and double check the HACCP plan.

Fig. 4. Seasoning of the cheese area well maintained in a farm.

By filling-in this check list you obtain a certain number that represents the risk of the whole structure. Subsequently The Official Veterinarian Health Service has established 5 risk classes to which are corresponding different deportments to follow (Table 1).

Table 1. Dairies classification according to risk value

Risk value	Risk class	Plant classification	Deportments to follow
2-30	1	Serious privation from structure and management	1. Stoppage of work 2. Proposal to revoke the CE license tag
31-55	2	Raised risk	Intensification of controls 1. Prescriptions (to resolve within deadline) of structure privation and HACCP plan 2. If necessary, slowing down of the production 3. Precised valuation of whole production chain: from milk collection/arrival of milk up to manufacturing and selling of the final product 4. If necessary verifying the hygienic aspects of the laboratory 5. Professional training of the responsible of the plant and/or employees
56-73	3	Light risk	Maintaining of hygienic controls as established in the Official Veterinarian Health Services plan
74-86	4	Elevated hygienic-sanitary standard and HACCP	Possible reduction of controls
87-100	5	Very good hygienic-sanitary standard and HACCP	Reduction of controls

From March to May 2005 a total of 35 milk samples have been collected in a casual way: a minimum of 7 samples per each farm. The milk samples have been analysed per fat, protein, lactose, solid not fat (SNF), cryoscopic index, total bacteria count, somatic cells and antibiotic-sulphamide residue.

The data related to milk quality have been analysed with the JMP statistic software (SAS Institute) and the results collected from the check list have been examined with the different strategies of the Critical Control Points (CCP).

Results and discussion

The risk values elaborated from the check lists are described in Table 2.

Table 2. Risk values of the 4 dairies that are producing *Pecorino di Lucardo* cheese

Farm	Risk value	Risk degree
A	62	3
B	42	2
C	39	2
D	18	1

Farm A has obtained an excellent score in comparison to farm B and C which are in the high risk class even if their score is very close the normality value expected.

Farm D has shown different privations due to structural requirements, plants and equipments as well as the privation of the HACCP plan.

The major differences of the check list are the following:

(i) Structural requirements, plants and equipments:

- Privation of disposable towels.
- Door to the bathroom that is not automatically closing.
- Bathroom s sink with manual water tap.
- Privation of waste baskets.
- Privation of thermometer in the cold store.

(ii) Maintenance and hygienic-sanitary management of the structure, plants and equipments:

- Inadequate maintenance of packaging machines, tables in the cold store, employees wardrobes and the door of the cold store.
- Presence of broken tiles.
- Walls with falling down plaster.
- Broken mosquito nets.
- Inadequate closing system of the cold store s door.

(iii) HACCP requirements:

- The revision of the plan is not foreseen.
- Privation of technical schedules of the products.
- Corrective actions are not defined.
- Privation of disinfections and rodent extermination procedures.
- Privation of procedures for sanitary brand.
- Privation of procedures for complains and returns.
- Privation of procedures for instruments calibration.
- Privation of procedures for the water control.
- Privation of the HACCP plan.

(iv) HACCP applications:

- Monitoring and recording CCP not conforming.
- Absence of verifying the rodent extermination program.
- Privation of registration of ordinary and extraordinary maintenance.
- Privation of professional training documentation.

The results of the milk qualities are described in Table 3.

Table 3. Results of the whole milk quality of the 4 farms that are producing the *Pecorino di Lucardo* cheese

Farm	Fat (%)	Protein (%)	Lactose (%)	SNF (%)	CI (°C)	TBC x 1000	SCC x 1000
A	6.12	5.17	4.80	11.08	-0.560	558.25 B	523.67 B
sd	1.93	0.98	0.22	0.14	0.02	869.02	197.37
B	5.96	5.56	4.82	11.04	-0.560	974.17 A	2433.00 A
sd.	0.43	0.11	0.11	0.07	0.023	1265.23	832.38
C	5.82	5.55	4.85	11.04	-0.570	2434.67A	1976.71 A
sd	0.35	0.12	0.07	0.13	0.01	1731.68	246.40
D	6.40	5.60	4.74	11.04	-0.580	2096.75 A	1384.20 A
sd	0.55	0.22	0.11	0.18	0.02	1640.43	531.47
Total	6.07	5.47	4.80	11.05	-0.569	1515.95	1579.39
sd	0.25	0.19	0.04	0.02	0.01	892.95	824.45

[A,B]Values with the same letter do not differ significantly.

Significant differences have not been registered for fat, protein, lactose and cryoscopic index while significant differences have been noted for CBT and SCC in farm A (the minor values in comparison to the other 3 farm values). This confirms that a good dairy management corresponds to a good breed management.

Nine *Pecorino di Lucardo* whole cheeses have been produced with this project. After 6 months of seasoning the cheeses have been visually analysed with the following results: not too many wholes in the cheese s pulp, neither solid nor dry but compact pulp, yellow straw-colour, hay, straw and Mediterranean herbs flavour. The taste that remains in your mouth after eating the cheese is very strong, bitter and persisting.

Apart from one farm, the others do not show heavy structural, plant and equipment problems in their dairies. This means that they have followed the adequate rules in order to be able to produce a traditional and historical cheese made by particular dairy techniques (Fig. 5).

Fig. 5. *Pecorino di Lucardo*. Not too many wholes in the cheese s pulp, neither solid nor dry but compact pulp, yellow straw-colour.

The farms in order to be able to produce the *Pecorino di Lucardo* cheese have to modify their production phases, according to the HACCP rules, especially for what concerns the vegetable rennet and the equipment used for the cheese preparation and the line-sackcloth.

In order to produce a cheese with raw milk you have to follow the requirements foreseen by the EC Rule no. 2073/2005 in particular for what concerns the hygienic and sanitary characteristics.

In conclusion, the valorisation of Mediterranean products such as the recovery of antiques cheeses receipts has to be subjected to today s laws concerning hygienic and sanitary characteristics, genetic improvement of different races breed and improvement of breeding techniques. Furthermore the monitoring processes should help to obtain cheeses of higher quality than the ones produced in the past.

Quality strategies and local farm produce in Mediterranean mountainous areas: The case of handmade goat's cheese in the southeastern Spanish Betic Massif

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SUMMARY – After discussing some points concerning food quality and its constituent parts, we address the issue of the quality of farm produce generally and, particularly, of small ruminant-derived foodstuffs. This is followed by a study of on-farm goat's cheese manufacturing in the mountainous rural communities of south-eastern Spain, identifying and analysing what herd and farmer characteristics are associated with the knowledge of handmade cheese-making techniques and manufacturing. A number of conclusions and recommendations are drawn from this analysis.

Keywords: Local products, agro-food quality, small ruminants, Mediterranean mountainous areas, hand-made goat's cheese.

RESUME – "Stratégies de qualité et produits fermiers locaux dans les zones montagneuses méditerranéennes : Le cas du fromage fermier de chèvre dans le massif bétique du SE de l'Espagne". Dans le présent travail, suite à quelques considérations concernant la qualité alimentaire et ses composantes, on aborde le thème de la qualité des produits d'élevages en général, et ceux qui sont dérivés des petits ruminants, en particulier. On analyse postérieurement le cas de la fabrication du fromage de chèvre par les fermiers, en identifiant et analysant leurs caractéristiques et celles des troupeaux qui sont en relation avec la connaissance des techniques de fabrication du fromage artisanal et avec sa production. Suite aux résultats antérieurs, quelques conclusions et recommandations ont été présentées.

Mots-clés : Produits locaux, qualité agro-alimentaire, petits ruminants, zones de montagnes méditerranéennes, fromage fermier de chèvre.

Introduction

The growing consumer demand for food quality in its broadest sense has opened up an opportunity for certain local products. Being handmade and produced according to a natural mode of production often on the farm itself, such products can be positioned within the quality food segment. This is because handmade modes of production and knowledge of the origin of products are consumer utility function elements that have a positive impact on consumers' appreciation of the quality of a given foodstuff.

Of this local produce, farm products generally and, especially, products derived from raising small ruminants are a key opening for cashing in on a quality-induced added value with the resulting impact on farmers' earnings and, ultimately, on the income level in rural communities in the Mediterranean mountainous areas. In these areas, considering livestock produce as a component activity of rural development processes entails boosting the quality of the products through handmade and natural modes of production, designations of origin, etc.

In this paper, after discussing some basic concepts concerning food quality and its constituent elements, we examine what possibilities there are for quality livestock products to participate in the local development of mountainous areas in the European Mediterranean. Finally, based on a survey of 156 goat farms in the Spanish Betic Massif (mountainous areas of Granada, Jaén, Málaga and Almería) on-farm cheese-making has been analysed and factors having an effect on this activity have been identified.

This paper includes the interim results of the project titled "Livestock Farming Systems in the Rural Development of Less Favoured and Mountainous Areas: Situational Analysis and Design of Strategies to Further their Role", funded by the Andalusian Regional Government's Agriculture and Fishery Council as part of the Agricultural Sector R D Programme, managed by the Andalusian Agricultural Research and Training Institute (IFAPA).

Food uality and local products

Food quality is a subjective concept related to what utility an individual gets out of the features of a given product. Consumers have, in some way, always rated the quality of the goods and services that they have the benefit of, but, lately, everything touching upon quality, and very especially with respect to the agrofood sector, has become a widespread social demand on the part of consumers, an element of the production function, with its respective cost, for the producers, and an institutional issue of great social importance for law-makers and the political class (Calatrava, 2005).

This as far as demand is concerned. On the supply side, we should add the potential that quality has as a marketing strategy, both as regards its appeal to consumers as well as its use as an element of supply-side segmentation and diversification. Linked at the institutional level to development policies, quality can prove to be an instrument for adding value to endogenous resources in rural areas, which, taking into account growing market demands, it would be difficult to efficiently and competitively exploit otherwise.

Numerous definitions are given in the literature for quality from different (functional, biological, organoleptic, regulatory, ethical, legal, health, etc.) viewpoints. From the viewpoint of consumer economic theory, quality is identified with a judgement issued by the consumer about a product's features. In this respect, Calatrava (2005) defines food quality as "the result of an ordinal judgement issued by the consumer regarding the components or attributes of a food from which he or she is likely to have utility". There are a variety of definitions based on the idea of "quality judgement", the first to use this concept in Spanish being perhaps Rivera's definition (1995).

There are a wide range of food consumption preference elements, which, being likely to give utility to consumers, are potential quality judgement components, the most common being: health (food safety), taste, smell, freshness (conservation), other organoleptic features, ease of purchase, origin, conditions and mode of production, visual appeal (packaging, presentation, etc.), brand, novelty, fashion, ethical elements, etc.

According to this definition, quality is subjective and depends on each individual, as does utility and its associated value. Producing quality is then synonymous with trying to satisfy consumer preferences.

The companies supplying food markets try, on the one hand, to comply with what they consider to be the mean or modal quality of all consumers and, on the other hand, diversify their product, by means of different quality levels, to meet the demands of particular groups of consumers or market segments. Company quality policy is, then, a response to the market and also a marketing strategy (Calatrava, 2005).

Locally produced foods are doubly important in the consumer utility function: on the one hand, as regards the key "health" component and, on the other, with respect to the specification of origin and the system of production. Consumers perceive local products to be handmade (as opposed to mass produced), natural, free of artificial additives and, therefore, healthier and more wholesome. Being handmade and natural, they are even perceived to have a positive differential in terms of organoleptic attributes, particularly taste and smell.

There are cases in which even the standard product is classed as "rural", "natural", etc., even if not all its varieties and forms are. Indeed, Calatrava and Sayadi (2006) show how, according to a Spanish Ministry of Agriculture, Fishery and Food survey (MAPA, 2004), Spanish consumers generally class goat's cheese as being more "rural", "handmade" and "natural" as compared with cheese made from cow's and sheep's milk, which they associate with other attributes.

Additionally, knowing exactly where a product comes from and even acquiring the product at origin is a positive element in the consumer utility function. Consumers have confidence in the quality of a product when they know how and where it is produced and even more so if they have seen it being made and/or have acquired it at the very place where it was produced.

Although there are European and national regulations defining and protecting certain forms of local products, i.e. Protected Designations of Origin (PDO) and Protected Geographical Indications (PGI), and Traditional Specialities Guaranteed (TSG) (see Calatrava and Sayadi, 2006, as regards local livestock products), there is, in our opinion, a massive vacuum as regards the regulations governing local and handmade products generally, both internationally World Trade Organization (WTO) regulations , nationally and regionally. This is an impending challenge, which should be taken up by the competent organisations and institutions in the immediate future.

Local livestock products and uality

Foods derived from livestock produce are likely to acquire the dimension of "handmade", "natural", "local" products, etc., that satisfy, as mentioned above, the consumer utility function. A whole new production and marketing strategy is needed to gain this dimension, which should be based, however, largely on local tradition and know-how (Flammant et al., 1998).

In earlier work, Calatrava and Sayadi (2006) examined the reasons why it is important to include local livestock produce in rural development processes in Mediterranean mountainous areas (tradition and local knowledge, rural tourism demand, economic diversification, etc.), as well as what factors block the promotion of these livestock products in development processes (limited knowledge regarding different market demand, climatic dependence, deficient infrastructure, etc.). Some of these reasons and factors are prominent as regard quality.

The local handmade livestock product can generate a differential added value with respect to conventional mass produced products in two ways: by fetching higher prices on the market, because of the quality differential, and by enabling shorter and more direct marketing channels, leading to a higher added value for producers.

When putting forward a possible "added value through quality" strategy for handmade livestock products, a number of strategic elements should be considered and analysed, including: place of production, production process used, where and how to get the product to consumers, level of diversification of outputs in the production process, and quality management and control system applied, if any.

In the following, we study the case of small-scale traditional handmade goat's cheese production by farmers themselves, within their household unit, sold directly on the farm or to local consumers and/or retailers, generally, without certified quality systems. In an earlier paper, Calatrava and Sayadi (2003) dealt with handmade cheese produced by small local industries that buy the milk from stockbreeders.

roduction of handmade goat s cheese by farmers

From a survey of 156 goat keepers in the South-eastern Spanish Betic Massif, we found that 71% of farmers sell milk to dairy companies or processing stations outside the district, all of which it used for cheese manufacture, 19.4% sell it to small local cheese-making companies or through cooperatives, and 9.6% of farmers, accounting for 6.8% of goats and milk production (663,000 litres/year), manufacture 75 tonnes of cheese on the farm/within the family unit and also sell 175,000 litres of milk to the outside. Of the cheese produced, 10% is for self-consumption and 90% is for sale. As half of the farmers that make cheese sell some of the milk that their herd produces to third parties, about 5% of farmers use all the milk that their herd produces to manufacture handmade cheese on the actual farm. From the above sample values, we estimate that farmers make some 2.500 tonnes of handmade goat's cheese across the whole region under study, of which approximately 10% is self-consumed and the remainder sold locally to destinations listed later.

Livestock farming families that produce cheese on their farm do so in relatively small quantities, seldom exceeding 500 kg/month in the production season. The cheese is used for sale and self-consumption by the family. Sales are made to neighbours, relations and local shops, although cheese is sometimes sold to private persons from another municipality or tourists acquainted with local cheeses. As regards self-consumption, the mean is 3 kg/month, where minimum and maximum self-consumption is 0.8 kg and 8 kg/month, respectively.

There are different types of farm cheeses, the most common being fresh and, to a lesser extent, semi-hard cheeses. When farmers keep mixed herds, more mature cheeses are sometimes made from a mixture of goat's and sheep's milk, always containing a higher percentage of goat's milk. It's worth to point out that despite the quantitative importance of Andalusian goat milk production, there is no one protected figure (PDO, PGI and ISG) concerning any goat dairy product in the region.

We also have found that almost half (48.1%) of farmers have, within their family unit, someone with knowledge of how to make the traditional cheeses of the region, although only 9.6% of farmers actually do make cheese. It is the farmer's mother (50.7%), wife (32.3%) or the farmer itself (17%) who has local knowledge of handmade cheese manufacture. We find then that the knowledge of cheese-making on farms is basically a female concern, and cheese manufacture, which used to be a widespread practice among livestock farming households, although it is now confined, as mentioned, to just one in every ten livestock farming families, is likely to have been so too.

Despite the above figures, the manufacture of handmade cheese by stockbreeders in Andalusia is much lower than in Spain as a whole. According to Spanish Ministry of Agriculture, Fishery and Food statistics (MAPA, 2002), some 40 million litres of goat's milk (39,725 million litres) are used to manufacture farm cheese in Spain, which is just under a tenth (9.16%) of what is sold to cheese-making industries (433,486 millions litres), whereas, in Andalusia, this percentage is only 3.63% of what is sold to factories (240 million litres), which accounts for 56% of the national total. The region where most milk is used to manufacture farm cheese is the Canary Islands, standing at 27 million litres, which is just over 50% of what is sold to the industrial cheese-making channel in the region (53.8 million litres). At the other end of the scale is Castile La Mancha, for example, where almost 100% of goat's milk (65.4 million litres) is sold to the cheese-making industry, there being almost no on-farm production.

With the idea of identifying what factors are related both to the knowledge and manufacturing of handmade farm cheese, we have specified and fitted two binomial probit models, the characteristics and results of which are described below.

Factors determining the knowledge and manufacturing of farm cheeses in the Andalusian Massif

To examine what farm- and farmer-related characteristics are linked with the knowledge of traditional cheese-making techniques in the family unit, we specified and fitted a binomial probit model, identifying this variable (YES there is knowledge – NO there is no knowledge) as dependent variable.

The initial explanatory variables of the model included the different levels of multinomial explanatory variables were: farm type (Farmtype), making a distinction between goat only and mixed goat and sheep or other farms employment type (Dedication) farm size: no. of breeding females (Farmsize) housing (Housing) farmer's age (Age) attendance of agricultural training courses (Course) educational attainment (Education) marital status (Mstate) and intention of continuing with goat farming in the long term (Contfarm) (See Table 1). The prediction model results, including only significant variables, are shown in Table 2.

The time spent on livestock farming is directly related ($p = 0.033$) to knowledge of traditional local cheese-making, in the sense that farmers working full-time are more likely to have someone in the family unit with knowledge of cheese-making techniques. There is also a direct relationship ($p = 0.002$) between farmer's age and the likelihood of there being local cheese-making knowledge. This is an important point, as it is precisely the older farmers that more often have someone in their family unit with this knowledge. This likelihood is, moreover, significantly greater ($p = 0.008$) among farmers

with small herds than those that own farms with larger-sized herds[1]. Similarly, farmers that state that they have less intention of continuing with goat farming in the long term are significantly (p = 0.002) more acquainted with how to manufacture traditional local cheeses. This places the know-how of handmade local cheese-making in the Betic Massif at risk. The likelihood of having this knowledge is greater (p = 0.091) among farmers with extensive herds than those that fully house their livestock.

Table 1. Definition of the explanatory variables of the binomial probit model

Variables	Description
Constante	Constant term
Farmtype	1, if the farm is goat only (monoactivity) and 0, otherwise
Dedication	1, if goat farming is your only full-time employment, and 0, otherwise
Farmsize	Size of goat farm (no. of breeding females)
Housing	1, if there is full housing, and 0, otherwise
Age	Farmer's age (years)
Education _1	1, if you are unqualified or have primary education, and 0, otherwise
Education _2	1, if you have lower secondary education, and 0, otherwise
Education _3	1, if you have upper secondary education, and 0, otherwise
Course	1, if you regularly attend agricultural training courses, and 0, otherwise
Mstate	1, if you are married and 0, otherwise
Contfarm	1, if you intend to continue with goat farming in the long term, and 0, otherwise

Table 2. Results of the "Knowledge of traditional local cheese-making" binomial probit model

Variables	Coefficients	t	p
Constant	-4.861500175	-3.113	0.0019
Dedication	0.5191786175	2.121	0.0339
Farmsize	-0.2076815245E-02	-2.622	0.0087
Age	0.6617830175E-01	3.065	0.0022
Housing	-0.3956398590	-1.686	0.0919
Contfarm	-0.8343739839	0.0025	0.0025

Log likelihood function: -95.38679 Restricted log likelihood: -108.0155
Chi-squared: 25.25752 Degrees of freedom: 5 Significance level:
p 0.001 PCC: 62.82%.

Paradoxically, neither educational attainment nor attendance of agricultural training courses has a significant influence on the knowledge of cheese manufacture in the family unit. Furthermore, marital status has no significant relationship to knowledge of local cheese-making.

Of the above points, the most worrying is the direct relationship between knowledge of cheese-making techniques and age, on the one hand, and the intention of giving up farming, on the other. These two aspects are cause for concern, as they indicate a possible loss of local knowledge in the short to medium term. Additionally, the age factor is doubly worrying because, according to farmers' responses, it is mostly their mothers that are in possession of the handmade cheese-making knowledge, and this is a generation that is on the verge of disappearance.

In a second stage of the analysis, a binomial Probit model, for stockbreeders who expressed their knowledge of traditional cheese-making technique, has been fitted to identify the farm- and farmer-related characteristics that most influence local cheese manufacturing in the family unit. This model

[1] Whereas the mean size of the surveyed herds is 210 head, the mean size of herds where there is knowledge of local cheese manufacturing within the family unit is 147 head.

has as dependent variable the binomial YES cheese is made – NO cheese is not made. The explanatory variables that the model specification accounted for initially were the same as in the previous model (see Table 1). The results of this model, including only significant variables, are shown in Table 3.

Table 3. Results of the "Cheese-making in the family unit" binomial probit model

Variables	Coefficients	T	p
Constant	-4.711374991	- 3.171	0.0015
Age	0.6617830175E-01	3.065	0.0022
Dedication	1.619505069	2.498	0.0125
Farmsize	-0.2687875281E-01	-2.599	0.0093
Contfarm	- 2.494246803	-2.953	0.0032

Log likelihood function: - 13.27164 Restricted log likelihood: - 51.58618 Chi-squared: 76.62908 Degrees of freedom: 4 Significance level: p 0.001 PCC: 60.32%.

The more time farmers spend on farming is directly (p = 0.012) related to cheese being manufactured on the farm. There is also a direct relationship (p = 0.002) between farmer's age and the likelihood of these cheeses being manufactured in the family unit. This likelihood is significantly greater (p = 0.009) among farmers with small herds than those that have farms with larger-sized herds. Similarly, farmers that have fewer intentions of continuing with goat farming in the long term are, significantly (p = 0.003), the ones that more often manufacture cheese in the family unit.

Logically, the significant variables are the same as for the knowledge variable, with the exception of housing (which is only significant at the (p = 0.090) level in the first model), since farmers who manufacture cheese have to know how to do it. Nevertheless, there are many who know how to make cheese but do not do so, because they prefer to sell the milk to third parties. In doing so, they avoid taking up even a local retailer role, something which livestock keepers and farmers generally are traditionally reluctant to do.

Neither the way in which animals are housed, the farmer's educational attainment, marital status, nor attendance of agricultural training courses have a significant influence on the likelihood of cheese being manufactured within the family unit.

Conclusions

Consumers' general growing demand for food quality contributes, among other factors to a demand for local handmade products, as localism and handmade agrofood produce are valued in the food quality judgement. In the case of small ruminant-derived products, this creates a market opportunity for locally manufactured handmade meat products, cheeses, other dairy produce, etc. This opportunity based on local quality means that livestock farming activities can take an integral part in the local development processes of rural areas, leading not only to economic but also to social and environmental benefits.

The Spanish region of the Andalusian Massif (eastern part of Andalusia-Spain) is a mountainous area where, traditionally, the keeping of goats, with approximately one million head, has been an important economic activity. As regards handmade cheese produced specifically on the farm, farmers from the area do have local knowledge of handmade cheese-making, as half of goat keepers have someone in their family unit that possesses this knowledge. Gender plays some role in this knowledge, as it is mostly women (farmers' elderly mothers in half of the cases) that possess this knowledge.

Although knowledge is relatively widespread, only one in every 10 farmers (9.5%) manufactures

cheese in their family units. Of the cheese manufactured by farmers, 10% is for self-consumption and 90% is sold through local channels mostly to relations, neighbours and local retailers and also, seasonally, to rural tourists.

The farmer's age is directly linked to both local knowledge of manufacturing techniques and actual cheese-making, which is particularly worrying taking into account that it is the farmer's mothers that possess the knowledge of the handmade cheese-making techniques. Related to some extent to the above, a greater proportion of the people who know how to make and actually do make cheese are farmers who are less likely to continue with livestock farming. Another variable related to both cheese-making knowledge and handmade cheese manufacturing is full-time employment in farming. This relationship could be more of a cause than an effect.

Variables like educational attainment, farmer's marital status or having taken part in agricultural training courses are generally unrelated to both knowledge and manufacturing of handmade cheeses by farmers.

The profile of a farmer that regularly manufactures cheeses in the family unit is, thus, generally an older person, who is a full-time goat farmer, managing a relatively small herd, and who logically has few intentions of continuing with goat farming in the future.

Results obtained from the Probit models are really not very promising, as there is the risk of the knowledge of traditional local cheese-making techniques disappearing, leading to the demise of the handmade production of those cheeses. Thus, strategies for rescuing and boosting local traditional cheese-making know-how call necessarily for actions aimed firstly at identifying the handmade manufacturing processes and then improving or adapting any suitable technology, without detracting from the product's "handmadeness". The strategy for maintaining and developing the production of handmade cheeses by farmers should necessarily entails a training programme for young farmers, based on the local knowledge there is on cheese-making techniques. Furthermore, the development of the current very little small-scale cooperativism existing for manufacturing and marketing farm cheeses would be also an important strategy. As regards marketing, there is a need for an increase and control of quality (and even certification) of the production and marketing process. In the future, increased production and process quality could lead to qualification for, in some more important cases, a Protected Designation of Origin, Protected Geographical Indication or, at least, Traditional Speciality Guaranteed.

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Meat from young goats raised in Argan Tree Forest (Morocco): Emerging product to valorise

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SUMMARY – During the past few years, the ecology of Argan tree forest (800 000 ha in SW Morocco) and the argan oil have been studied extensively. Goats, particularly the rearing of yearling males, constitute an important component of the argan farming system. Young goats are reared outdoors on the argan rangelands without conventional concentrate supplies, except some argan by-products. Recent experiments supported by the PRAD programme (PRAD 0011) showed that in comparison with an indoors feeding (usual system in Morocco) the meat produced by argan tree grazing, supplemented or not, presents lower lipids and cholesterol contents, higher proportions of *n–6* and *n–* (PUFA) and a lower *n–6/n–* PUFA ratio, which results in beneficial characteristics for human health. The meat of these goats is appreciated mainly by local consumers: this was confirmed by the sensory panels during the experiments. But, in Morocco, the frequency of cardio-vascular diseases is progressing and consumers are tending to coming back to traditional products. Kids raised in the Argan area present the characteristics to cover the demand of Moroccan consumers in the future. Due to the limited number of carcasses produced, this meat could be only a niche product. For developing its market, it would be better to organize the production and trade chain by setting up goat farmers groups and an organization involving all partners such as slaughterers and butchers.

Keywords: Argan tree forest, goat meat, young goat, dietetic quality, fatty acid composition, typical product.

R SUM – *"La viande de chevreaux élevés en Arganeraies (Maroc): un produit émergent à valoriser". Pendant ces dernières années, l'écologie de la for t d'Arganiers (800 000 ha dans le SO du Maroc), et de l'huile d'Argan a été étudiée de fa on approfondie. L'élevage de caprins, en particulier de jeunes m les, constitue une importante composante du système agraire de l'Arganeraie. Généralement, les chevreaux sont élevés à l'extérieur sur les parcours, sans apport de concentré excepté les sous produits de l'Arganier. Des recherches récentes soutenues par le programme PRAD (PRAD 0011), montrent qu'en comparaison avec le système d'alimentation classique au Maroc à base essentiellement de concentré, la viande produite sur le p turage de l'Arganeraie avec ou sans concentré présente des teneurs plus basses en lipides et en cholestérol dans les muscles, une proportion plus élevée d'acides gras polyinsaturés (AGPI) en n–6 et n– , et un rapport AGPI n 6/n plus faible. Ces caractéristiques sont favorables pour la santé humaine. A présent, la viande de caprins élevés en Arganeraie est principalement appréciée par les consommateurs locaux. Cela confirme les résultats de panels de consommateurs réalisés pendant ces expériences. En outre, au Maroc, les maladies cardio vasculaires progressent et la nouvelle tendance des consommateurs est de revenir à des produits traditionnels. Les chevreaux élevés en Arganeraie présentent des caractéristiques pour répondre à la demande des consommateurs marocains à l'avenir. En raison du nombre limité de carcasses produites, le marché de ce produit se limite à une niche commerciale. Pour développer ce marché, il serait nécessaire d'organiser sa filière en créant des groupes d'éleveurs et en mettant en place une structure représentant tous les acteurs de la filière.*

Mo s s: *Arganeraie, viande caprine, chevreau, qualité diététique, composition en acides gras, produit typique.*

The Argan ecosystem

Argan forests occupy an area of 800,000 ha and contain around 26 to 30% of the Moroccan goat population (El Aïch, 1995). The Arganeraie is a three-component farming system based on barley, Argan tree and goats. Barley has several functions: it is a staple diet of the people, and its straw, thatch (stubble), and grain are also used as animal feed. The second component, the Argan tree (which doubles as a fodder and fruit tree), constitutes the heart of this agrarian system. The local

population of goats makes up the third component. The meat goat production made up an important part of the incomes of goat breeders. Goats and particularly the rearing of yearling male goats constitute an important component of the Argan farming system. Usually, young goats are reared outdoors on the Argan rangelands without conventional concentrate supply, except some Argan oil by-products. Boscher (1992) estimated that Argan forest and Argan by-product, notably the pulp of the fruit named "alig", contributed to 50% of goats' nutritional needs.

The problem statement

In Arganeraie, goats are considered as rustic animals. They take less advantage of the supplementary feeds as compared to the other animal species. Most of their feed comes from grazing areas (75 to 80% of their needs). Bousquet (2000) pointed out the predominance of grazing in the Argan forest, especially from August to December. The high variability of the contribution of Argan trees to goats' diets according to the different grazing areas as well as to the climatic nature of the year were underlined by Person (1998), El A ch (1995) and Bousquet (2000). Indeed, during the dry periods the feed supply coming from Argan tree forest could be not sufficient to meet energy and nitrogen requirements for maintenance and growth. In these conditions, the goat breeders were forced, either to sale a part of their livestock or to give Argan by-products.

Consequently, from the findings of this research the goat as it is raised in the Argan area presents all the characteristics of typical product or niche product. Therefore, we got to raison the following question: Is the goat meat produced in Argan forests adapted to the new requirements of Moroccan consumers, particularly in towns, owing to its dietetic quality?

The typicity of the meat of goats from the Argan area

Argan niche

The Argan tree *(Argania spinosa)* is an endemic tree found in the South-western part of Morocco. In this region, the Argan forest is also important in terms of the conservation of the environment and for the local economy by supplying wood for heating, forage and meal for animal feeding and oil extracted from nuts for human food and cosmetic products. The major income of goat farmers is derived from the sale of live goats and Argan goat farming is predominant because goats use Argan tree products (leaves, nuts) as main components of their diet and browse trees when herbaceous resources are limited (El A ch, 1995 El A ch *et al*., 2006). When resources from Argan trees cannot meet the maintenance and growth requirements of goats, goat farmers sell a part of their flock or supply Argan by-products.

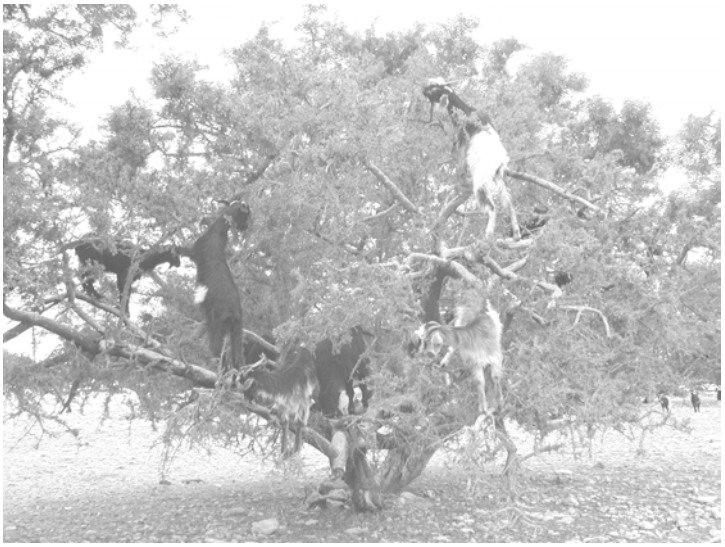

Fig. 1. Local "Haha" goats grazing into Argan trees.

Goat population

"Haha" goats are known for their ability of climbing Argan trees (Fig. 1). The learning of the young animals (less than 3 months) by older ones is predominant. According to livestock holders, goats coming from other areas never climb into the Argan trees. Climbing ability of goats depend on the physiological stage. Indeed, gestating goats, old goats and bucks during mating season never climb into the trees to graze. Falls of goats from the trees are frequent. According to holders, 10 to 30% of goats broke their legs as result of falls from the trees.

Husbandry and feeding systems

According to a survey realised in the Tamanar area, there are 3 types of goat holders (Bousquet, 2000). Presentation of these three types of husbandry systems is provided in Table 1. Feeding systems depend on many interacting factors such as:

(i) The availability of supplementary feeds (Argan by-products and concentrate) that impacts directly the grazing activities of goats

(ii) The availability of other pastoral resources (herbaceous layer) and agricultural residues (straw and stubble) determined the contribution of Argan trees to goat feeding.

(iii) The availability of sylvo-pastoral resources that are controlled by the socio-economical management as well as the access to these resources (El A ch *et al*., 2005).

Table 1. Husbandry and feeding systems in Tamanar (region of Essaouira) (Source: Fiat, 1989)

Types	Small holders (20 to25 %)		Medium holders (65 to 70%)		Large holders (<10%)
Size of goat flock (1 year)	15-20	30-40	40-80	60-100	100
Size of sheep flock	<10	30-40	<10	30-40	50-100
Herding	Family's members	Family's members	Family's members	Family's members or salary workers	Family's members or salary workers
Other feed supplies	No other feed	During droughts	During droughts	During droughts, and priority to sheep	During droughts, and period of feed shortage
Product: meat	Kids and culled animals	Kids and culled animals	Kids and culled animals	Kids and culled animals	Kids and culled animals and castrated bucks

Feed resources that contribute to goat diet are very diverse. Overall, total contribution of Argan trees (leaves and fruits) ranged from 47 to 84% according to the period of the year. Argan leaves are the main component of goat diet along the year (35 to 68%). Argan fruits are consumed from April to June. Other plant species have seasonal contribution. For instance, herbaceous species that responded to rain are consumed during early spring. Oleastre leaves are mainly consumed during late season (September to December) when the under trees layer availability becomes short.

Typical meat quality

Studies conducted (Bas *et al*., 2005) shown that meat from goats which had access to the Argan forest for grazing, could be differentiated from that of goats fattened indoor, by a specific fat and fatty

acid profile (Table 2). This difference of composition expressed on the one hand, a more intense ruminal activity, and in the other hand a diet richer in polyunsaturated fatty acids (PUFA). The higher content of PUFA of the serie *n*-3 and the lower percentage of palmitic acid in the meat of goats which could graze in the Argan forest result in a favourable composition for consumers' health. Moreover, the concentrate supply to the goats which could graze in the Argan forest had a beneficial effect on growth rate, but had low effect on fat depot weights and on fatty acid composition of adipose tissues and of muscles. Thus, the main interest of this concentrate supply could be seen in term of economy when grazing resources were very low. Recent experiments supported by the PRAD programme (PRAD 0011) showed that in comparison with an indoors feeding (common feeding systems based on concentrate in Morocco for meat lamb and goat production), the feeding method based on Argan tree grazing with concentrate or not presents the following advantages in regards of dietetic quality of meat: lower contents in lipids and cholesterol in muscles, an higher proportion of *n–6* and *n–* polyunsatured fatty acids (PUFA) and a lower *n–6/n–* PUFA ratio. The low fat content and FA profile of the meat from the goats reared in Argan tree forest results in beneficial characteristics in regards of human health (Wood and Enser, 1997).

Table 2. Fatty acid composition of adipose tissues and of muscles of goats

	Adipose tissues†			Muscles		
	ZP	PA	PP	ZP	PA	PP
$C_{16:0}$	29.0[a]	24.1[b]	25.4[b]	20.3[a]	19.0[b]	19.0[b]
$C_{18:0}$	33.1[a]	35.8[ab]	35.0[b]	14.5[a]	17.6[b]	17.9[b]
$C_{18:1n9c}$	20.9[a]	16.1[b]	14.8[b]	45.7[a]	33.4[b]	32.1[b]
n-6 PUFA††	1.5[a]	2.6[b]	2.8[b]	6.0[a]	10.1[b]	11.2[b]
n-3 PUFA†††	0.07[a]	0.45[b]	0.55[b]	0.8[a]	3.1[b]	3.3[b]

†Adipose tissues (average values from omental and perirenal tissues).
††*n*-6 PUFA: polyunsaturated fatty acids of the serie *n*-6, consisted of: $C_{18:2n\ 6}$ $C_{18:3n\ 6}$ and $C_{20:4n\ 6}$ for the adipose tissues and $C_{18:2n6}$, $C_{18:3n6}$, $C_{20:2n6}$, $C_{20:3n6}$, $C_{20:4n6}$, $C_{22:4n6}$, for the muscles.
†††*n*-3 PUFA: polyunsaturated fatty acids of the serie *n*-3, consisted of: $C_{18:3n\ 3}$ for the adipose tissues and $C_{18:3\text{-}n3}$, $C_{20:3n\ 3}$, $C_{20:5n\ 3}$, $C_{22:5n\ 3}$, $C_{22:6n\ 3}$, for the muscles.
Two values from the same line with a same letter are not significantly different, with 2 different letters are significantly ($P<0.05$) different.

In addition, finding of the sensory tests (Table 3) indicated that the meat of goats reared in Argan tree forest is appreciated mainly by consumers in this area: this was confirmed by the results of sensory panels during the experiments. But, in Morocco, the frequency of cardio-vascular diseases is progressing quickly. On the other hand, a new tendency Moroccan consumer is aimed at coming back to traditional products.

Table 3. Consumer test on goat meat from young goats reared on 3 different feeding systems

Treatments	No access to Argan	Access to Argan and concentrate	Access to Argan without concentrate
Score†	2.6	4.3	4.8

†Score from 0 (lowest appraisal) to 5 (highest appraisal).

Typical product

This meat of young goats presents a very marked typicity. Firstly, the animal management in Argan forest recalls consumers of the past traditional rearing methods using the available vegetation specific of the area and opposite to the indoors intensive methods based on feeds produced out of the area where young goats are reared. Secondly, this meat production depends on the aerial grazing of the Argan tree. Consequently, the production area is linked to the presence of Argan trees which

distinguish the South-western region of Morocco between Essaouira and Agadir. All these characteristics make of this kid meat a typical product ("produit du terroir") defined by a region with well defined borders, a typical goat population capable to climb on trees, and a specific feeding based on Argan leaves and nuts. But it is also a biological product favourable to human health because goats consume this specific vegetation.

ow to valorise this product

The major problems to be solved are the place of this niche product amongst other competitive meats, the maintenance of this specific goat management, the organization of the production and trade chain ("filière") and the reach of consumers likely to be interested by the dietetic quality and typicity of this product.

The Moroccan consumers are very fond of mutton or lamb meats, less goat meat except in some regions as in Arganeraie. But currently, mutton meat is considered as too rich in fat and little favourable to human health. Probably, it is an opportunity for developing the communication on the dietetic quality of young goat meat by pointing out the effect of limiting the risk of cardio-vascular diseases. Still, we must keep in mind that the advanced experimental results above mentioned, do not evidence whether the dietetic quality observed is correlated with goat species or if it can also be observed on other ruminants, particularly on lambs reared in Arganeraie or equivalent extensive environment.

The target to reach is that the consumers with sufficient income are willing to purchase goat meat raised in the Arganeraie. In Arganeraie, peoples traditionally appreciate goat meat but they have limited income. However, in bigger agglomerations of the Arganeraie such as Essaouira, emerge a new social class with improved enough income that appreciate goat meat and usually accept to go to rural souks (weekly markets in rural areas) to purchase the meat of kids fed with Argan leaves and by-products. Such class of people are concerned with health risks and are proud of traditional products. As far as we are concerned, we think that this new social strata should constitute the target to reach.

We got also to involve groups of goat farmers for the valorisation of such niche product in order to find new opportunities for selling which will surely improving the income of farmers. Any valorisation of the product should consider the adaptation of a common strategy for commercial aspects and by cooperating with the other partners of this filière (production and trade chain) such as slaughterers, butchers, etc. Such task is not easy since goat producers of the Arganeraie are small holders and not accustom with group efforts as it is the case for sheep producers in other regions of Morocco. We have to take into account the sociological environment of this region, namely the different concerns of small and larger holders (see Table 1).

The decision makers must decide whether the help of ANOC (National Association of Sheep and Goats Breeders) which has not a large experience in goat sector can be efficient or not. This Association can implement one or several goat farmers groups and prepare an agreement pooling all rules of production of young goat meat in the Argan tree forest. Afterwards, an independant institution could be nominated for controlling all farmers concerned are in accordance with these rules so as to deserve a label: carcasses of young goats reared in Arganeraie.

This agreement should be discussed with foresters managing the Argan trees forest and Argan oil producers organizations. Particularly the valorisation of young goat meat should promote the sustainability of Argan forest. On another hand, production of such a meat should interfere with production of Argan oil made from Argan nuts, and particularly should not modify the quality of this oil which is now largely valorised at the export.

This strategy to be set up is new and original in Morocco. It must be well adapted to socio-economic conditions characteristics of vegetation and environment in this region, and to cooking traditions of consumers. Similar proceedings have always been managed in some North European countries, particularly by setting up farmers' groups and an organization supporting a quality product, as to manage together the policy of production, trade and product quality (Dubeuf, 1995). Advisory services can help these organizations (Léger, 2001). In most cases, the diversity of production systems must be accepted to facilitate agreement between producers. An approach for valorising

pastoral areas due to extensive systems of small ruminant meat production can improve the "image" of meat product (Léger, 1999).

Conclusion

This study shows that Mediterranean products have specific and interesting qualities but still need to be better valorised.

We are aware of the efforts which got to be dedicated to the success of the development and valorisation of the production of young goats meats reared in Arganeraie. This success depends on the self-awareness of goat farmers, the commitment of decision makers and the capacity of consumers to be sensitive to product's quality.

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Les produits de l'élevage ovins steppiques : Cas des agneaux de Djelfa

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RESUME – Cette étude est menée parce qu'il n'existe que peu de sujets de recherche s'occupant des marchés du bétail, en particulier ayant trait à la commercialisation des produits ovins dans la steppe algérienne. En fait, il s'agit du chaînon manquant dans la chaîne de commercialisation de la viande rouge (ovine), surtout concernant la destination et les prix des produits de l'élevage. Les résultats de cette recherche sont basés sur un suivi du marché ovin dans la région de Djelfa en 2003-2004. Cette zone est au cœur des activités pastorales et constitue en fait le premier fournisseur d'agneau d'Algérie, dont la viande est fortement appréciée des consommateurs. Les différents systèmes d'élevage pratiqués dans la région de Djelfa donnent lieu à trois types d'agneau : (i) El Bakri : Cette catégorie d'agneaux est bien appréciée en raison de ses performances démontrées en matière de poids et de son prix de vente élevé sur le marché, la période d'agnelage du type El Bakri étant octobre-décembre : (ii) El Aidoudi : Généralement le type El Aidoudi vient dans une seconde période d'agnelage et son prix de vente est plus faible que celui du type El Bakri ; et (iii) El Saifi : La période d'agnelage du type El Saifi correspond aux jours les plus chauds de l'été. Les performances de poids sont limitées et on note un fort taux de mortalité.

Mots-clés : Marchés, Djelfa, viande ovine, agneau, El Bakri, El Aidoudi, El Saifi.

SUMMARY – "Sheep products from the steppe: The case of Djelfa lambs". This study takes place since few research subjects deal with livestock markets, particularly those related to the marketing of sheep products in the Algerian steppe. Actually, this is the missing link in the red meat (ovine) marketing chain, particularly the destination and the prices of livestock products. These research outputs are based on 2003-2004 ovine market follow-up in the Djelfa region. This location represents the focus of pastoral activities and indeed the first supplier of lamb in Algeria where the meat is very much appreciated by consumers. The different breeding systems practised in Djelfa yield 3 types of lamb: (i) El Bakri: This category of lamb is well appreciated because of its proved performances in weight and its high selling price on the market. The lambing period of El Bakri is October-December; (ii) El Aidoudi: Mainly El Aidoudi come in second lambing period and their selling cost is lower compared to El Bakri; and (iii) El Saifi: The lambing period of El Saifi corresponds to the hottest days of the summer. The weight performance is limited and a high mortality rate is recorded.

Keywords: Markets, Djelfa, sheep meat, lamb, El Bakri, El Aidoudi, El Saifi.

Introduction

Forte de sa très grande étendue, avec sa situation géographique reliant les grandes zones d'agglomérations (Nord, est et Sud de l'Algérie), et riche de la diversité de ses parcours naturels (Armoise, Alfa, etc.) et de ces produits ovins, la région de Djelfa est, au niveau économique et humain, une grande région d'élevage d'herbivores.

En effet, Djelfa a très longtemps été connue au niveau national comme une grande région de production de viandes rouges notamment ovines. A l'échelle des zones d'élevage pastorales, elle occupe une position de leader. Avec un troupeau de près de 1 200 000 de brebis viande, sa production est surtout composée d'agneaux finis de 20 à 27 kg vifs. De ce fait, elle participe de façon importante à l'approvisionnement des grandes Wilayat[1] du pays.

Selon les circuits d'abattage officiels de la région de Djelfa, la production de viandes ovines

[1] La viande de l'agneau de Djelfa est très appréciée par le consommateur national et étranger (Tunisie et Maroc). L'importation de la viande congelée n'a eu aucun effet sur les prix de la viande ovine.

s élève 21 000 quintaux durant la période 2004, soit l équivalent de 140 000 Agneaux[2]. En réalité, cette production par rapport l effectif de brebis reproductrices n explique pas le niveau réel des performances zootechniques car les circuits d abattage non contr lés sont très nombreux au niveau local. Le développement des marchés anarchiques des viandes rouges a en fait favorisé ce type de spéculation lucrative et rend aujourd hui très difficile l estimation de la production des viandes ovines.

Cette étude tentera d aborder un maillant de la filière viande ovine qui jusqu présent reste fort peu étudié et ce, fin de caractériser l agneau de Djelfa et d évaluer son prix dans le temps. Cette recherche aspire donc combler ce vide et servir de référence pour le développement des zones d'élevage.

M thodologie

Compte tenu des objectifs que nous nous sommes fixés et la difficulté d aborder ce type d étude cause de l indisponibilité des données sur les marchés ovins, la méthodologie adoptée repose sur un suivi hebdomadaire de marché bestiaux durant les campagnes 2002-2003 et 2003-2004.

Les données collectées sont relatives aux aspects suivants : (i) les prix des différents produits d élevage (brebis, agneaux, etc.) (ii) les opérateurs économiques et leurs lieux de provenance et (iii) les prix des aliments de bétail en particulier l orge en grain.

L outil de collecte est basé sur un questionnaire et sur des discussions ouvertes. Un des objectifs de cet outil est de déterminer le statut des opérateurs économiques et leurs impacts sur les prix des agneaux.

Caract risti ues de la one d tude

La région de Djelfa est située dans la partie centrale de l Algérie dont le chef lieu est 300 kilomètres au Sud de la capitale. Les parcours recouvrent plus de la moitié de la superficie de la région dont 50 % sont localisés principalement dans la zone présaharienne. La végétation naturelle est composée de plantes aromatiques (Armoise) donnant ainsi un go t particulier la viande d agneau.

La réduction des parcours et les années de sécheresse n'ont pas eu d'incidence particulièrement sur l'effectif du cheptel. En effet, durant la dernière décennie, l effectif ovin, s est maintenu au environ de 2 010 541 têtes (Tableau 1).

Les prix élevés des ovins et la disponibilité des aliments de bétail au cours de cette période ont évité la baisse des effectifs d'animaux (DSA, 2004).

Tableau 1. Evolution des effectifs ovins et des précipitations (Source : DSA Djelfa 2004)

Années	1994	1995	1996	1997	1998	1999
Effectifs (têtes)	1 899 350	2 084 680	2 194 000	1 097 416	2 019 229	2 285 300
Précipitation (mm)	371	281	439	391	177	295,5
Années	2000	2001	2002	2003	2004	
Effectifs (têtes)	2 284 500	2 002 180	1 949 500	2 071 000	2 228 800	
Précipitation (mm)	152,2	238,9	212,8	289,03	375	

Les transformations dans la conduite d élevage (développement d'un élevage base de ressources cultivées) ont fait basculé la région de Djelfa d un espace pastoral o le système de

[2] Le poids moyen d une carcasse d agneau est de 18 kg.

production était intégralement fondé sur l'utilisation des ressources fourragères naturelles à un espace agropastoral marqué par la prédominance de la céréaliculture en sec (Boutonnet 1989, Kanoun et Kanoun, 2004). Cependant, le point commun entre les différents systèmes d'élevage (sédentaire, semi-transhumant et transhumant) est la production d'agneaux comme il y a longtemps : un agneau précoce (El Bakri), un agneau de printemps (El Aidoudi) et un agneau d'été (El Saifi).

Résultats et discussions

L'analyse des informations collectées au niveau du marché ovin a permis de constater la diversité des produits d'élevage notamment la présence des agneaux finis et maigres durant toute l'année. Cette disponibilité s'explique par la grande variété de systèmes d'élevage qui persistent utiliser les mêmes pratiques ancestrales.

Les agnelages sont étalés tout le long de l'année. Cependant, le nombre de naissances le plus important est concentré durant la période hivernale-automnale. Cette caractéristique des élevages steppiques ovins s'explique par la présence des béliers dans les troupeaux toute l'année.

Les différents types d'agneaux : Une préférence pour l'agneau précoce El Bakri

Trois types d'agneaux sont produits par les éleveurs de Djelfa. Cette différentiation est liée d'une part, la période de naissance et d'autre part au rendement en viande (Tableau 2). L'agneau El Bakri est précoce. La période de naissance de ce type d'agneau se situe entre les mois d'octobre et novembre. L'agneau El Aidoudi est né en printemps (mars-avril). Ce produit est apprécié par les éleveurs car sa naissance co ncide avec une meilleure disponibilité fourragère naturelle mais son poids reste inférieur celui d'El Bakri. uant au dernier type d'agneau (El Saifi), les naissances sont concentrées principalement en été. Les grandes chaleurs estivales sont très défavorables sa croissance et les poids obtenus sont largement plus faibles que ceux réalisés avec les deux autres catégories d'agneaux (Tableau 2).

Tableau 2. Caractérisation des différents types d'agneaux (Sources : suivi INRAA 2003-2004 et calculs propres)

Age des agneaux	Années†	El Bakri		El Aidoudi		El Saifi	
		Prix (Da)	Poids vif (kg)	Prix vif (Da)	Poids vif (kg)	Prix vif (Da)	Poids vif (kg)
3-6 mois	2003	9 900	18	9 150	18	9 400	14
	2004	10 670	20	10 486	22	9 950	15
6-9 mois	2003	11 425	25	10 975	25	8 400	22
	2004	13 775	30	13 400	27	13 150	23

† 2003 : 1 Euro = 90 Dinars, 2004 : 1 Euro : 89 Dinars.

Les résultats consignés dans la Fig. 1 concernant la comparaison des catégories d'agneaux gés de 3 6 mois et de 6 9 mois font appara tre bien la différence des prix. Les données montrent en effet que le prix moyen de l'agneau El Bakri est plus élevé que ceux enregistrés avec les deux autres catégories d'agneaux.

Cet indicateur économique explique en fait la préférence des éleveurs pour ce type d'agneau. Pour se mettre dans une position de négociation de force, les opérateurs économiques adoptent des stratégies basées sur l'intégration d'El Bakri dans des lots d'agneaux hétérogènes (El Aidoudi, El Saifi) afin d'obtenir des prix élevés.

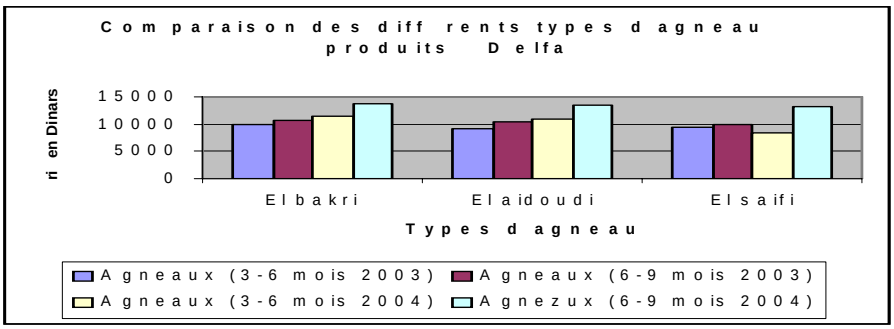

Fig. 1. Comparaison des différents types d'agneaux produits à Djelfa.

Evolution du prix des agneaux : Une différence significative

La réalisation des tests univariés de significativité a permis de mettre en évidence une augmentation significative ($p<0,05$) du prix des agneaux entre 2003 et 2004 (Fig. 2) et ce, pour toutes les catégories.

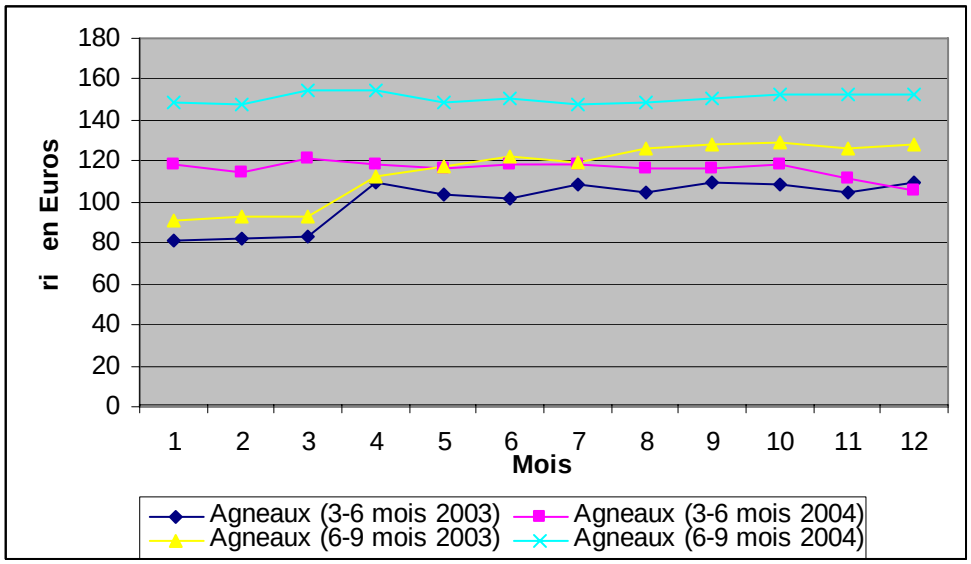

Fig. 2. Evolution du prix des agneaux.

Le prix moyen des agneaux âgés de 3 à 6 mois est passé de 9059 dinars en 2003 à 10 337 dinars en 2004, soit une croissance de 14%. En ce qui concerne, les agneaux (6-9 mois) l'augmentation du prix moyen est de 26%.

Selon Bedrani (1995) la variation du prix des animaux élevés en milieu pastoral est liée étroitement aux conditions climatiques. Il est certes que ce facteur naturel a un effet sur la fixation des prix mais les transformations en matière de conduite alimentaire des élevages steppiques contribuent également dans la formation du prix en l'occurrence celui des agneaux.

En effet, cette dernière décennie le prix des aliments de bétail joue un rôle important dans la fixation des prix des animaux. Selon Boutonnet (1999) les ressources fourragères gratuites sont saturées et le recours aux aliments de bétail est systématique.

La viande produite aujourd'hui dans le monde provient de la transformation de plantes cultivées (Boutonnet, 1999). Actuellement, la complémentation des animaux sur les parcours dure en moyenne six mois (Kanoun et Kanoun, 2004). Cette dépendance vis-à-vis des ressources cultivées s'explique par l'incapacité des parcours à couvrir les besoins alimentaires des animaux (Bouchetata, 2002).

Indépendamment du type d'agneau considéré, le prix de l'orge a connu une augmentation significative ($p<0,05$) entre 2003 et 2004 (Fig. 3). Cependant, l'analyse des données illustrées dans la Fig. 4 montre que le prix de l'orge enregistre une augmentation durant les cinq derniers mois de l'année.

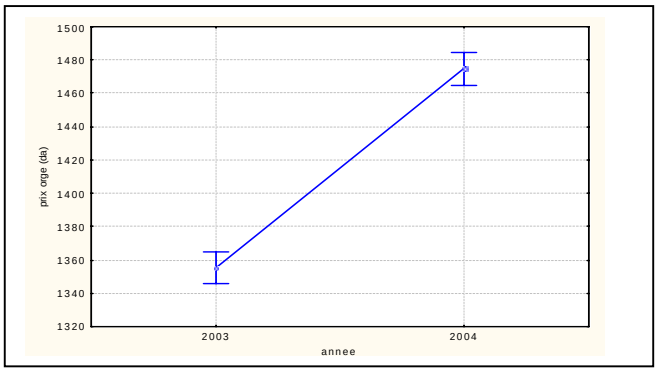

Fig. 3. Variation du prix de l'orge.

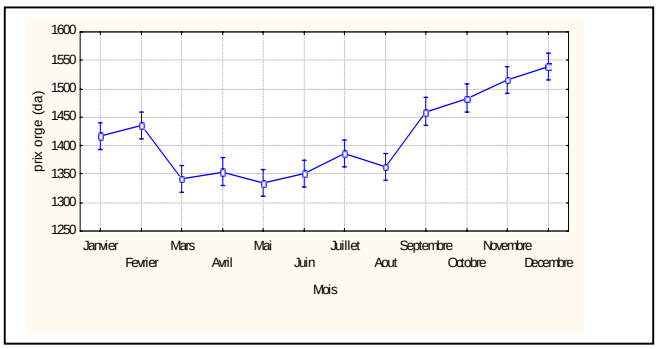

Fig. 4. Variation du prix de l'orge durant l'année.

Cette période est en fait marquée par une faible production des parcours et une croissance des besoins alimentaires des animaux notamment ceux des brebis en fin de gestion et suitées. Les éleveurs n'ont pas d'autres alternatives que de recourir aux approvisionnements en aliments de bétail : orge, son, ma s, etc. Comme l'illustre la Fig. 5, le nombre d'éleveurs naisseurs est plus élevé durant cette période et ce, par rapport au reste de l'année.

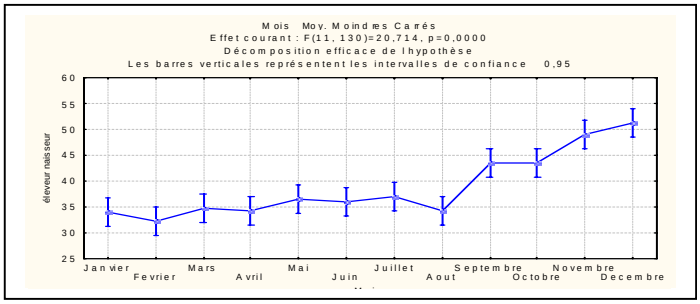

Fig. 5. Variation du nombre d'éleveurs naisseurs.

Par ailleurs, l'analyse de la présence des opérateurs économiques au niveau du marché ovin de

Djelfa révèle une augmentation significative ($p<0,05$) des engraisseurs à partir du mois de juin. On note même une corrélation positive (Tableau 3) entre le nombre des éleveurs naisseurs ($r = 0,69$) et ceux des engraisseurs ($r = 0,57$).Cela se traduit par une forte tension sur les aliments de bétail en particulier l'orge en grain.

Les facteurs à l'origine de la fixation du prix des agneaux

L'analyse des corrélations montre que le prix de l'agneau dépend du prix de l'orge, du poids de l'animale et de la présence des opérateurs économiques sur le marché en l'occurrence les éleveurs naisseurs et les engraisseurs (Tableau 3).

Tableau 3. Le prix de l'agneau et les principaux facteurs dépendants

Variables	Prix agneau	Prix orge	Poids agneau	Eleveurs naisseurs	Engraisseurs
Prix agneau	1.00	0,38	0,61**	0,32	0,28
Prix orge	0,38	1,00	-0,03	0,69**	0,57**
Poids agneau	0,61**	-0,03	1,00	-0,00	-0,02
Eleveurs naisseurs	0,32	0,69**	-0,00	1,00	0,58**
Engraisseurs	0,28	0,57**	-0,02	0,58**	1,00

**$p<0,05$.

Ces facteurs sont les principaux moteurs de fixation du prix des agneaux. La présence de ces opérateurs économiques notamment des régions frontalières (Tunisie), se traduit par une forte demande sur l'orge en grain et dont les conséquences se répercutent sur la formation du prix de l'agneau. Cette demande sur l'orge est beaucoup plus intense durant les périodes d'engraissement des animaux pour les fêtes religieuses.

Ces pratiques de commercialisation du cheptel ovin marque les nouvelles tendances des activités d'élevage au niveau des zones de parcours. Les stratégies des opérateurs économiques sont orientées vers l'intensification des systèmes d'élevage. La croissance de la demande pour ce type de viande de part et d'autre de la frontière a favorisé l'émergence de ces pratiques spéculatives.

Conclusion

La production de l'agneau reste le principal produit des élevages steppiques ovins. En dépit des importations des viandes congelées ces dernières années, la production de l'agneau a pu garder sa place privilégiée auprès des consommateurs.

Compte tenu du niveau de production des élevages ovins agropastoraux et les préférences des consommateurs, le prix de la viande ovine notamment celle des agneaux connaitra une augmentation, en tendance, au cours des prochaines années. En effet, les ressources provenant des parcours sont limitées à cause de leur état de dégradation avancé (Bedrani, 2001) et toute augmentation de production de viande ovine ne pourra se faire que grâce à l'incorporation des ressources cultivées dans l'alimentation animale.

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Colour characteristics of *so ress* obtained from *ser* pig autochthonous ancient genetic type AAGT

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SUMMARY – The aim of the research was to investigate colour characteristics of *soppressata* stored for 45 and 90 days under vacuum and under perirenal fat. The products were obtained from 20 pigs (10 castrated males and 10 entire females) belonging to AAGT *Casertana*, reared in multiple boxes at ConSDABI experimental farm. For each *soppressata* the colorimetric profile was determined on 7-8 samples by using spectrophotometer (U3000, Hitachi) equipped with integrated sphere. The results showed that: (i) castrated males provide a product with higher redness value (a*) and a lower hue value at 45 days if stored under perirenal fat, while the females showed higher yellowness value (b*) when stored under vacuum; and (ii) at 90 days of storage the differences in the colour characteristics are confirmed.

Key words: Salami, *soppressata*, colour, *Casertana* pig.

R SUM – *"Caractéristiques colorimétriques du* soppressata *issu de porcins de l'ancien type génétique autochtone* Casertana *(GAA)". La présente recherche a étudié la couleur de la* soppressata *après une conservation sous vide et sous panne pendant 4 et 90 jours. Le produit a été issu de 20 sujets (10 m les castrés et 10 femelles entières) du GAA* Casertana *élevés dans des box multiples près de la structure expérimentale du ConSDABI. Le profil colorimétrique, relevé par spectrophotomètre (U 000, itachi), pour chaque* soppressata*, a été obtenu à partir de 7 8 échantillons. Les résultats mettent en évidence que : (i) après 4 jours de conservation les m les castrés donnent un produit avec un indice élevé de rouge (a) et une valeur plus petite de teinte s'il est confectionné sous panne (P 0,0), au contraire, les femelles ont des valeurs plus élevées (P 0,0), et aussi pour l indice de jaune (b) si le produit est conservé sous vide et (ii) après 90 jours de conservation les différences colorimétriques relevées pendant la première période se confirment.*

Mo s s : *Salami,* soppressata*, couleur, porc* Casertana*.*

Introduction

In Italy, the ancient salami tradition, different in relation to the climatic conditions and to the various AAGTs reared, was characterized from heterogeneity of products. But, in the last years, the strong heterogeneity between salami has been lost and some salami was increasingly characterized rather by standardized "flow diagram" than the genetic origin of the raw matter. This situation has led to a wide diffusion of some salami on whole national land and limitation of other ones only in specific production area.

The *soppressata* is a typical and traditional product broadly diffused, in the past, in the South of Italy with some different denominations: *lucana*, *calabrese*, *di Gioi*, etc. The qualitative characteristics of a cured product, such as the *soppressata*, are due not only to the raw matter used but also to the

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endogenous enzyme activity and environmental conditions such as temperature, humidity, conditions of storage, etc.

In this study, the effect of sex as well as of conditions of storage and period of storage on colour characteristics of *soppressata* obtained from pig AAGT *Casertana* was investigated.

Material and methods

The research was carried out on *soppressata sannita* stored for 45 and 90 days under vacuum and under perirenal fat. The *soppressata sannita* was manufactured in Circello (BN) by the partial ham trimming, *Longissimus dorsi* and subcutaneous fat in the proportion of 2-3% out of the total meat weight employed. During the ripening period, about 45 days, humidity and temperature were checked.

The experimental relieves were carried out on 20 subjects (10 castrated males and 10 entire females) belonging to AAGT *Casertana*, reared in multiple boxes at ConSDABI experimental farm. The spectrophotometric profile (from 380 to 780 nm) and L*, a*, b* with the four illuminants A, B, C and D65, were determined on 7-8 samples from each *soppressata* by using spectrophotometer (U3000, Hitachi) equipped with integrated sphere.

Data were analysed by GLM procedure of SAS (SAS Institute) using sex, condition and conservation period, and first order interactions as fixed factors. Using this model the average of the levels of each factor were estimated and weighted for all factors considered singularly and interactively (Matassino *et al.*, 1984). The significance of the differences between the means was evaluated by Students t test.

Results

The results point out that at 45 days of conservation the *soppressata* obtained from castrated males, in comparison with that obtained from entire females has, on average, a higher red index (a*) and a lower hue value if stored under perirenal fat, a higher lightness value ($P < 0.01$) and a lower hue value if stored under vacuum (Table 1).

The comparison between two storage conditions within the sex, shows significant differences only for the lightness value, higher under vacuum that under fat ($P < 0.01$).

Reflectance spectrum (Fig. 1) shows a globally lighter colour in the product stored under vacuum for 90 days and obtained by females, while *soppressata* stored under fat for 45 or 90 days looks darker and flatted.

The conservation of *soppressata* under perirenal fat, in the past, was a way to reduce the significant variations of the colorimetric and rheological characteristics of the product in the long time. Indeed, the perirenal fat might avoid a fast dryness of the external part of the salami, allowing a minimum decrease of the humidity. In the *soppressata* stored under vacuum, on the contrary, the humidity fraction is unchanged explaining the higher lightness value observed.

The absence of nitrite and nitrate in the mixture makes the product "more natural", but allows the final colour to be on average darker, in comparison with the product prepared with their addition. The higher value of a* is a good index of the lean fraction of the product, according to Montemurro *et al*. (1991). Extending the conservation period for other 45 days, the colorimetric differences between the two sexes were unchanged for both lightness and red index as well as for hue with the A illuminant, while no significant difference was observed with the other illuminants, except for L* value. This suggests that the A illuminant is more suitable to detect eventually differences in the colour of salami with a higher meat percentage.

The variations of colorimetric characteristics of the product between 45 and 90 days are not statistically significant.

Table 1. Effect of storage conditions and period, separately for castrated males (♂) and entire females (♀)

Characteristic	45 d				90 d			
	Fat		Vacuum		Fat		Vacuum	
	(♂)	♀	(♂)	♀	(♂)	♀	(♂)	♀
Illuminant A								
L*	32.72	31.89	34.82^{A}	33.25^{B}	33.42^{A}	31.40^{B}	35.78^{A}	33.08^{B}
a*	7.14	6.98	7.36	7.51	7.08^{a}	5.82^{b}	7.37	6.48
b*	6.96	7.30	7.10	7.41	7.58	7.42	7.11	7.17
Chrome	10.30	10.60	10.53	10.95	10.81	9.95	10.55	10.10
Hue	46.22	51.24	45.64	47.58	48.43^{A}	55.57^{B}	45.84^{A}	51.83^{B}
Illuminant B								
L*	32.08	31.24	34.17^{A}	32.57^{B}	32.77^{A}	30.82^{B}	35.14^{A}	32.47^{B}
a*	5.12	5.06	5.25	5.44	4.92	3.99	5.25	4.58
b*	6.65	6.91	6.77	7.01	7.39	7.23	6.79	6.88
Chrome	8.9	9.25	9.01	9.41	9.44	8.94	9.00	8.84
Hue	53.79	58.19	53.5	54.6	56.52^{a}	63.31^{b}	53.98	59.65
Illuminant C								
L*	31.86	31.01	33.04^{A}	32.33^{B}	32.54^{A}	30.62^{B}	34.89^{A}	32.25^{B}
a*	3.63	3.62	3.71	3.90	3.32	2.59	3.69	3.15
b*	6.59	6.80	6.70	6.91	7.37	7.19	6.73	6.80
Chrome	8.13	8.48	8.18	8.54	8.71	8.38	8.16	8.15
Hue	61.46	65.21	61.51	61.97	64.43	70.65	62.12	67.31
Illuminant D65								
L*	31.84	30.89	33.91^{A}	32.30^{B}	32.52^{A}	30.59^{B}	34.87^{A}	32.23^{B}
a*	3.94	3.93	4.09	4.22	3.65	2.90	4.01	3.46
b*	6.41	6.64	6.52	6.73	7.17	7.01	6.55	6.63
Chrome	8.11	8.47	8.18	8.55	8.66	8.31	8.16	8.11
Hue	59.17	63.10	59.12	59.71	62.13	68.50	59.68	65.03

$^{a,b}P < 0.05$ $^{A,B}P < 0.01$.

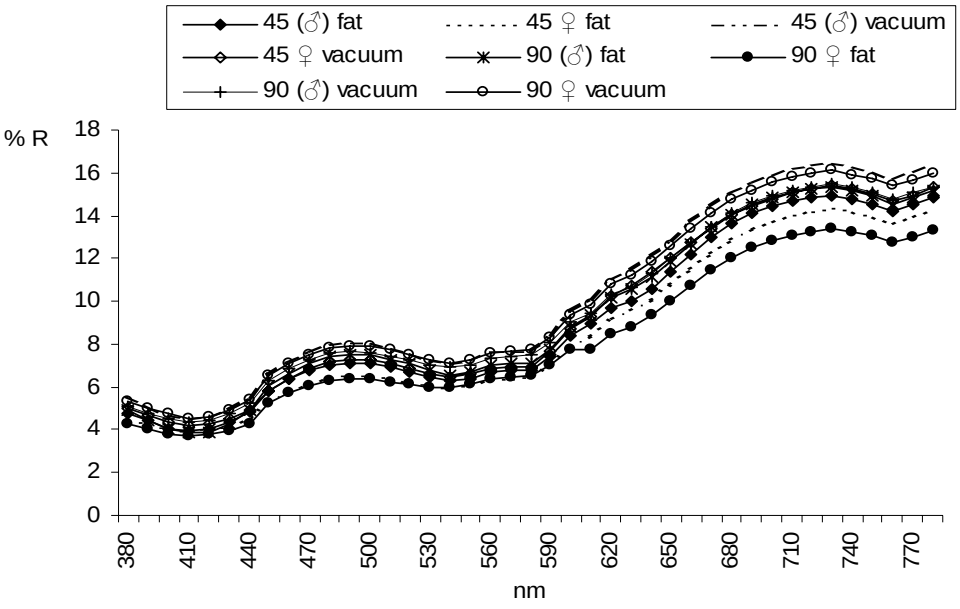

Fig. 1. Reflectance spectrum in relation to considered factors.

Conclusions

The results of the research showed the influence of sex in determining the lightness value of *soppressata* stored under vacuum for both 45 and 90 days, with castrated males that have higher values. The product stored under perirenal fat, instead, showed significant differences between the two sexes only at 90 days. Finally the A illuminant was more able to detect differences in the colour of this salami that has a high meat percentage.

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Some "typical traditional" products obtained from Casertana pig autochthonous ancient genetic type (AAGT): Ripening loss[1]

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SUMMARY – The study was carried out on some "typical traditional products" obtained from the Casertana pig, an AAGT mostly reared in Campania (Italy), in order to point out possible differences between genders during the ripening period. The products were obtained from 35 castrated males and 22 entire females reared in multiple boxes at ConSDABI experimental farm and slaughtered at 160 kg of live weight. Within the limits of the field of observations, by comparing castrated males and entire females we observe that the difference in ripening loss percentage in the salsiccia sannita is not significant, and in the fiocco sannita, pancetta (tesa and arrotolata) sannita and prosciutto (dry cured ham) sannita are significant ($P < 0.05$). The weight ripening loss difference in lardo sannita, soppressata sannita and capocollo sannita are normally significant ($P < 0.05$).

Key words: Casertana, autochthonous ancient genetic type, ripening loss.

RESUME – "Quelques produits traditionnels typiques issus de porcins de l'ancien type génétique autochtone (TGAA) Casertana : Pertes à la maturation". L'étude a été conduite sur quelques produits "traditionnels typiques" obtenus à partir du TGAA Casertana, élevé surtout en Campanie (Italie), pour mettre en évidence l'effet du facteur sexe sur les pertes à la maturation. Les produits ont été issus de 35 mâles castrés et 22 femelles entières, élevés dans des box multiples près de la structure expérimentale du ConSDABI et abattus à un poids moyen proche de 160 kg. Dans le domaine d'observation, la comparaison mâle castré et femelle entière a mis en évidence que la différence en perte pourcentuelle lors de la maturation n'a aucune signification pour la salsiccia sannita, et est significative ($P < 0,05$) pour le fiocco sannita, le pancetta (tesa et arrotolata) sannita et le prosciutto sannita. La différence de diminution pondérale de la maturation était normalement significative ($P < 0,05$) pour le lardo sannita, le soppressata sannita et le capocollo sannita.

Mots-clés : Casertana, type génétique autochtone ancien, diminution de la maturation.

Introduction

Salami production is an ancient technique to preserve and make pig meat available for a long time from slaughtering too. In the past years some products were strictly linked to geographical area and the presence, in Italy, of different pig autochthonous genetic types (AAGT) allowed a wide diversification of salami. Currently, the technological innovation allows the production for the whole year of "standardized" salami obtained from cosmopolite breeds.

The reduction and/or the extinction of some autochthonous genetic types and the abandonment of agriculture may be considered as responsible for the loss or deep decrease of some "typical traditional products".

The rediscovery of local traditions and the rescue of AGTT are concretizing in the possibility to give an impulse to a sustainable development of the agri-ecosystem favoring the local economy

[1] Research supported by MiPAF (Ministry of Agriculture Policy and Forestry), by the Campania Region and by the Benevento's Province.

according to the optimal use of autochthonous resource (Matassino, 2001). The present study is a part of a wide project aimed at the valorization and productive use of *Casertana* AGTT through quanti-qualitative evaluation of some "traditional typical products".

Material and methods

The study was carried out on the following "traditional typical products": *capocollo sannita*, *fiocco sannita*, *lardo sannita*, *pancetta* (*tesa* and *arrotolata*) *sannita*, *prosciutto sannita, salsiccia sannita* and *soppressata sannita*, obtained from 57 subjects (35 castrated males and 22 entire females) belonging to *Casertana* pig AAGT, reared in multiple boxes at ConSDABI experimental farm and manufactured at a salami factory in Circello (BN).

The half carcasses, kept in a refrigerated room at 2-4°C for about 72 hours, were dissected separating the lean cuts from fatty cuts.

Each product, obtained from meat manufacturing of the single animal, without preservatives (nitrites and nitrates), was periodically (daily, weekly or monthly Table 1) monitored for weight loss during the whole ripening period.

Table 1. Monitoring sequence distinctly for single product

Product	Ripening period								
	0 d	6 d	15 d	20 d	30 d	40 d	90 d	180 d	360 d
Capocollo									
Fiocco									
Lardo									
Pancetta arrotolata									
Pancetta tesa									
Prosciutto									
Salsiccia									
Soppressata									

Experimental data for *fiocco sannita*, *pancetta* (*tesa* and *arrotolata*) *sannita* and *prosciutto sannita* were corrected for the animal live weight, while those obtained for *capocollo sannita*, *lardo sannita*, *salsiccia sannita* and *soppressata sannita* were corrected for the initial weight of the respective product.

The significance of the differences between means was evaluated by Students t test.

Results and discussion

From data reported on Table 2 it is possible to evidence a quite similar behaviour between sexes during ripening of *salsiccia sannita* with an apparently higher loss in the castrated male in comparison with entire female (51% *vs* 46%).

Table 2. *Salsiccia sannita*. % loss in some ripening periods, distinctly by sex

Subjects (n)	Sex	Loss (%)	
		15 d	30 d
35	Castrated male	39.65	51.36
22	Entire female	30.92	46.11

Capocollo sannita (Table 3 and Fig. 1) which, at beginning of ripening showed a mean weight of 3.13 kg and 2.88 kg in the castrated male and entire female, respectively, after six months displays a loss of 46% and 40% respectively, with a significant difference (*P* 0.05) only in the first month (2.35 *vs* 2.34).

Table 3. *Capocollo sannita*. Corrected weight loss, expressed in kilograms (kg), during ripening period, distinctly by sex

Sex	Ripening period (d)					
	0	6	14	30	90	180
Castrated male	3.130	3.050	2.630	2.350[a]	1.870	1.680
Entire female	2.880	2.840	2.530	2.340[b]	1.980	1.720

[a,b]*P* 0.05.

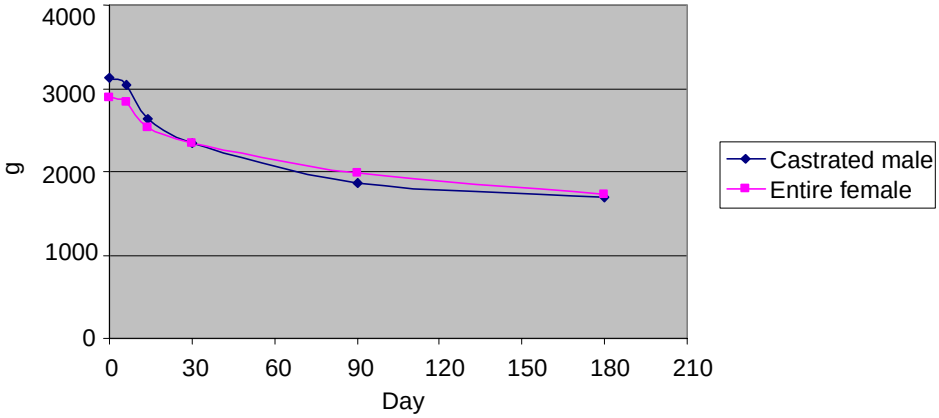

Fig. 1. *Capocollo sannita*. Variation of corrected weight loss, expressed in grams (g), during the ripening period, distinctly by sex.

As regards the other considered products, Tables 4 to 7 and Fig. 2 show that the percentage loss of *fiocco sannita*, *prosciutto sannita*, *pancetta* (*tesa* and *arrotolata*) *sannita,* and weight loss of *lardo sannita* and *soppressata sannita* are higher (*P* 0.05) in the castrated male in comparison with entire female, at any time considered.

In particular, comparing data concerning fiocco and dry cured ham (Table 4), after one year of ripening, it evinced that the former shows, apparently, an higher percentage loss than the latter, both in castrated male (39.7 *vs* 30.5) and entire female (33.5 *vs* 21.4), likely due to the different preparation procedure, as the two products, derived from leg, are composed by exclusively (or nearly) the same muscles: *Semimembranosus*, *Biceps femoris* and *Semitendinosus*.

Table 4. *Fiocco* and *prosciutto sannita*. % loss in some ripening periods, distinctly by sex

Subject (n)	Sex	Product	Loss (%)			
			30 d	90 d	180 d	360 d
35	Castrated male	*Fiocco*	14.4[a]	20.6[a]	33.1[a]	39.7[a]
		Prosciutto	0.42[a]	20.9[a]	27.0[a]	30.5[a]
22	Entire female	*Fiocco*	12.5[b]	17.1[b]	26.9[b]	33.5[b]
		Prosciutto	0.5[b]	13.8[b]	18.7[b]	21.4[b]

[a,b]*P* 0.05.

At the end of ripening, *soppressata sannita* (Table 5 and Fig. 2), obtained from partial trimming of ham and *Longissimus dorsi* with addition of lumbar subcutaneous fat in the proportion of 2-3% out of the total meat weight employed, had a percentage loss equal to 49.5% in castrated male and 44.7% in entire female and the difference was not significant.

Table 5. *Soppressata sannita*. Corrected weight loss, expressed in grams (g), during the ripening period, distinctly by sex

Sex	Ripening period (d)				
	0	10	20	30	40
Castrated male	488[a]	354[a]	299[a]	264[a]	246[a]
Entire female	473[b]	363[b]	314[b]	280[b]	262[b]

[a,b]*P* 0.05.

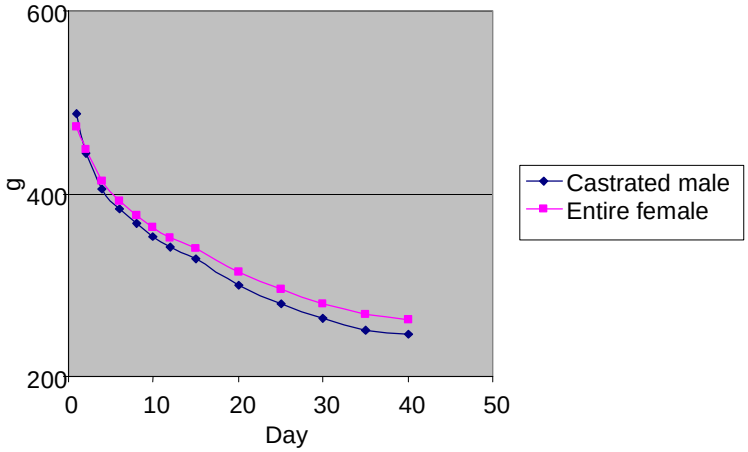

Fig. 2. *Soppressata sannita*. Variation of corrected weight loss, expressed in grams (g), during the ripening period, distinctly by sex.

Pancetta tesa and *arrotolata* (Table 6) had a percentage loss at any considered period and at the end of ripening (after six months) apparently higher in the former than the latter in both castrated male (34.3 *vs* 32.1) and entire female (26.2 *vs* 25.2).

Table 6. *Pancetta tesa* and *arrotolata sannita*. % loss in several ripening periods, distinctly by sex

Product	Subjects (n)	Sex	Loss (%)			
			15 d	30 d	90 d	180 d
Pancetta tesa	26	Castrated male	19.9[a]	25.8[a]	32.4[a]	34.3[a]
	22	Entire female	15.2[b]	18.5[b]	23.7[b]	26.2[b]
Pancetta arrotolata	32	Castrated male	15.8[a]	19.6[a]	26.8[a]	32.1[a]
	22	Entire female	13.3[b]	15.8[b]	21.4[b]	25.2[b]

[a,b]*P* 0.05.

At the end of ripening (five months), *lardo sannita* (Table 7), obtained from dorsal fat collected from

6th thoracic vertebra to 1st lumbar vertebra (including the latter) had a percentage loss equal to 10.8% in the castrated male and to 6.4% in the entire female this difference was not significant.

Table 7. *Lardo sannita*. Corrected weight loss, expressed in kilograms (kg), during ripening period, distinctly by sex

Sex	Ripening period (d)	
	0	150
Castrated male	5.300	4.730[a]
Entire female	6.850	6.410[b]

[a,b]*P* 0.05.

Conclusions

The results evidenced that for all considered typical traditional products castrated male, shows a higher loss in both percentage and in weight, according to a previous research (Barone *et al.*, 2003). Such difference could be due to different texture of adipose tissue (a good saturated fatty acid content) as well as to a higher intramuscular fat content in females (data not published).

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Sensory characteristics of *ros o* dry cured ham and *o o* obtained from pig ancient autochthonous genetic type AAGT *ser*

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SUMMARY – The aim of this study was to evaluate the sensory characteristics of two products: *prosciutto* (dry cured ham) and *fiocco*, seasoned for 24 and 12 months respectively, obtained from castrated males and entire females of pig AAGT *Casertana*. On 18 hams and 20 *fiocco*, at the end of the ripening period, colour profile (L*, a*, b*) with spectrophotometer (U3000) and rheological traits of single muscle with TPA and compression test were detected. The results showed values of redness and yellowness significantly lower in *fiocco* in comparison with *prosciutto*, which provides better rheological characteristics due to the longer seasoning period, hence the higher proteolysis and lipolysis. Females provided both products with better traits in comparison with males ($P < 0.05$).

Key words: *Fiocco*, dry cured ham, *Casertana*, pig.

R SUM – *"Caractéristiques sensorielles du* prosciutto *(jambon sec) et du* fiocco *issus de porcins de l'ancien type génétique autochtone* Casertana *(GAA)". L'objectif de l étude a été l évaluation qualitative de deux produits : le* prosciutto *après un temps d affinage de 24 mois, et le* fiocco*, après un temps d affinage de 12 mois, tous deux issus de m les castrés et de femelles entières appartenant à l'ancien type génétique autochtone (GAA)* Casertana*, élevés principalement en Campanie (Italie). Sur 18* prosciutti *et 20* fiocchi *à la fin du séchage ont été relevés : la couleur (L , a , b), en utilisant le spectrophotomètre U 000 muni d une sphère intégratrice, et les caractéristiques rhéologiques de chaque muscle par le tessurometer et l Instron. Les résultats ont mis en évidence des valeurs de rouge et de jaune de fa on significativement inférieures dans le* fiocco*, par rapport au* prosciutto *qui, à cause d un plus long temps d affinage et, donc, d une plus grande protéolyse et lipolyse, a montré de meilleures valeurs des caractéristiques rhéologiques. Les deux produits fournis par des femelles se sont révélés meilleurs.*

Mo s s : Fiocco*,* prosciutto*,* Casertana*, porc.*

Introduction

The *prosciutto* of Parma is now known in worldwide for its particular characteristics as well as Serrano, Iberico and Bayonne, typical productions of the different Mediterranean countries, that occupy important market niches. The *fiocco*, or *culatello*, as it is named in Northern Italy, is, together with the ripened *prosciutto*, a pig product of remarkable value it derives, similarly to *prosciutto*, from leg and has a ripening period of 12 months. On the contrary, the typical traditional *prosciutto* has a longer ripening period: 24 months and it s usually obtained from ancient autochthonous genetic type (AAGT).

In the last years, consumer s attention is increasingly orientated towards the rediscovery of some typical traditional productions obtained from AAGT. *Casertana* is one of these pig AAGT and its productive revaluation and utilization has involved us from several years. The results of other

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research point out that *Casertana* pig has peculiar qualitative characteristics of raw matter, essential requisite for obtaining ripened products of quality (Matassino *et al.*, 1991 Zullo *et al.*, 2003). In this study the results concerning some qualitative characteristics (rheological and colorimetric) of *fiocco* and *prosciutto*, detected at the end of the ripening, obtained from castrated males and entire female of *Casertana* AAGT are reported.

Material and methods

The study compared 20 fiocchi (10 obtained from castrated males and 10 from entire females) and 18 prosciutti (13 obtained from castrated males and 5 from entire females) of *Casertana* AAGT. The pigs were reared in multiple boxes at ConSDABI experimental farm and slaughtered at 160 kg of live weight. The two products were ripened for 12 and 24 months respectively at salumificio in Circello (BN).

At the end of the ripening period, from each products a slice of not less than 1.5 cm of thickness was removed for the relief of sensory characteristics.

The determination of colorimetric (L*, a*, b*) and rheological (hardness, cohesiveness, springiness, adhesiveness, chewiness) characteristics was performed using U3000 Spectrophotometer (Hitachi), equipped with integrating sphere, and Texturometer (Zenchen Tockio) separately on three different muscles: *Biceps femoris* (Bf), *Semimembranosus* (Sm) and *Semitendinosus* (St), as well as on the backfat. Furthermore, using Instron Universal Testing Machine, model 5540, compression parameters were detected: hardness, elasticity, cohesiveness and chewiness.

Data were elaborated by MI ED (SAS, 2004) procedure using the subject as casual factor and the sex as fixed factor. In order to obtain a total estimation of the product value, the muscles were considered as repeated measure. The evaluation of the effect of the muscle as fixed factor was obtained by GLM procedure. The significance of the differences between the means was evaluated by Students t test.

Results and discussion

The qualitative answer obtained by the texture profile analysis evidenced higher values ($P < 0.05$) of hardness (21%), springiness (25%) and chewiness (26%) in the *fiocco*, if compared with *prosciutto*, when it was obtained from castrated male (Table 1).

Table 1. Effects of sex castrated males = (♂), and entire females = ♀ on qualitative traits of *fiocco* and *prosciutto*

Characteristic	Product	Sex		Comparison between sex
		(♂)	♀	
Hardness	*Fiocco*	22.96[a]	16.85	xxx
	Prosciutto	19.24[b]	16.34	
Elasticity	*Fiocco*	4.30[A]	6.07	xxx
	Prosciutto	5.57[B]	5.83	
Cohesiveness	*Fiocco*	0.47	0.23	x
	Prosciutto	0.31	0.28	
Chewiness	*Fiocco*	21.07	25.40	
	Prosciutto	24.37	24.37	

[a,b]$P < 0.05$ [A,B]$P < 0.01$.

On the contrary, there were no significant differences between the two products obtained from the entire female, even if the values tended to be higher in the *prosciutto*.

The slice of *fiocco*, under 70% compression, in the castrated males, requires a maximum load of more than 17% ($P < 0.05$) in comparison with slice of *prosciutto* as it is harder by 22% and less springy by 27%. There was no significant difference between the two products obtained from the entire female. The results obtained suggest that the ripening for 24 months determined a product with better rheological characteristics which may be explained by slower proteolysis and lipolysis which in *prosciutto* reduce some possible differences due to the sex that are detectable in the *fiocco* also after 12 months. Čandek-Potokar *et al*. (2002) observed that *prosciutto* obtained from the female has a more compact texture due to a lower content of intramuscular fat, in disagreement with Matassino *et al*. (1987), who on eight pig genetic types reported higher tenderness for *prosciutto* derived from females. The Italian typical traditional *prosciutto*, in comparison with the other Mediterranean prosciutti, such as Serrano, Parma or Corso evidenced lower values for hardness and chewiness (Monin *et al*., 1996).

In both products, the *Semitendinosus* is lighter, less red and has a lower value ($P < 0.05$) of chewiness, springiness and hardness, while the *Semimembranosus* has different characteristics (Table 2).

Table 2. Mean value of qualitative characteristics of muscles of *fiocco* and *prosciutto* separately for castrated males (♂) and entire females ♀

Trait	Product	(♂)				♀			
		Fat	Muscle			Fat	Muscle		
			Bf	Sm	St		Bf	Sm	St
Illuminant A									
L*	*Fiocco*	66.65	37.93^{b}	37.12^{b}	34.09^{a}	62.57	36.70^{b}	36.88^{b}	33.95^{a}
	Prosciutto	70.12	35.08^{b}	36.24^{b}	32.95^{a}	67.31	39.75^{A}	38.67^{B}	33.47^{A}
a*	*Fiocco*	5.95	9.08^{A}	9.72^{A}	6.16^{B}	2.99	12.58	11.28	8.05
	Prosciutto	5.20	10.66^{A}	11.44^{A}	8.37^{B}	5.97	13.70	13.93	10.97
b*	*Fiocco*	7.77	7.78	8.09	7.52	6.04	6.69	5.87	5.18
	Prosciutto	9.57	7.10	8.33	7.09	8.98	8.18	9.80	10.72
Compression test									
Hardness	*Fiocco*	18.24	25.62	33.66	16.15	10.65	18.26	27.89	9.35
	Prosciutto	15.31	23.17	22.96	15.44	13.59	17.74	22.20	11.84
Elasticity	*Fiocco*	3.80	3.58	4.34	4.42	6.33	6.07	6.05	6.41
	Prosciutto	6.21	4.56	5.53	5.95	6.47	5.25	5.10	6.59
Cohesiveness	*Fiocco*	1.05	0.52	0.32	0.30	0.09	0.28	0.28	0.28
	Prosciutto	0.10	0.45	0.32	0.32	0.15	0.32	0.33	0.25
Chewiness	*Fiocco*	23.70	31.20	47.49	17.80	6.40	28.55	47.69	16.77
	Prosciutto	9.19	20.30	38.43	30.24	10.00	26.86	39.29	19.80
Texture profile analysis									
Hardness	*Fiocco*	7.36	4.47	6.27	4.34	4.71	3.42	5.78	3.38
	Prosciutto	6.38	4.19	4.97	3.06	5.63	4.08	4.62	2.54
Springiness	*Fiocco*	12.79	12.84	12.78	12.84	12.75	12.87	12.79	12.85
	Prosciutto	12.72	12.70	12.80	12.83	12.73	12.72	12.73	12.72
Gumminess	*Fiocco*	391.50	310.49	445.06	299.70	246.05	232.04	384.45	210.43
	Prosciutto	337.55	288.35	337.99	199.06	318.61	291.03	306.65	154.92
Chewiness	*Fiocco*	5011.11	3970.73	5682.81	3879.06	3137.67	3000.16	4926.82	2733.14
	Prosciutto	4296.86	3661.40	4331.57	2559.25	4057.00	3704.55	3904.10	1972.21

$^{a,b}P < 0.05$ $^{A,B}P < 0.01$.

In comparison with *prosciutto*, *fiocco* appeared globally less red and its outer fat has lower values of lightness ($P < 0.01$) and yellowness ($P < 0.01$). On the contrary, there were no differences between the two products as regards lightness of the lean portion (Table 2).

Conclusions

ualitative characteristics of *prosciutto* were significantly different from those of *fiocco*, showing lower values of cohesiveness, springiness and chewiness.

At the light of the results obtained, the productive use of ancient autochthonous genetic types might be addressed to products characterized by long ripening periods, which allow to raw matter to express better the qualitative potentiality, probably also due to a slower proteolysis and lipolysis.

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Une application pratique de la traçabilité individuelle chez l'agneau à viande. La première certification de traçabilité individuelle de viande d'agneau en Espagne

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RESUME – Description de l'implantation d'un système de renforcement de la qualité par la traçabilité de chaque phase de la production de viande d'agneau. Ce processus est devenu un système d'amélioration progressive de chaque phase de production en contrôlant depuis l'achat d'aliment pour l'engraissement des agneaux jusqu'à la commercialisation du produit.

Mots-clés : Traçabilité, certification, identification électronique, sécurité alimentaire, audit.

SUMMARY – "A practical application of individual traceability in meat lambs. The first certification of individual meat lamb traceability in Spain". Description of the implementation of a system of quality assurance through the traceability of each phase of production of the meat lamb. This process has become a progressive system of improvement of each stage of production, controlling production right from the purchase of feed for the fattening of the lambs up to the sale of the product.

Key words: Traceability, certification, electronic identification, food safety, audit.

Introduction

En mai de 2002 on a constitué la Société Ovired Calidad SL formé par un groupe d'éleveurs d'ovin à viande des régions Cinca Medio et Bajo Cinca et par les vétérinaires en charge de la santé de ces exploitations d'élevage.

L'objectif a été de garantir la qualité du produit par l'application d'un projet qui assure l'intégrité du processus à l'intérieur et à l'extérieur de l'exploitation à partir de la traçabilité en arrière (traçabilité des produits qui entrent dans l'exploitation) en passant par la traçabilité du processus dans l'exploitation, transport vif, abattage, et transport du produit, ainsi que la correcte identification du produit de telle sorte qu'au cas d'un problème, on pourrait réaliser le suivi, la détection et l'application des mesures correctrices pertinentes.

À l'objet de garantir ces conditions, un organisme externe certifié doit auditer deux fois par année : la fabrique d'aliments, les exploitations, l'abattoir, et les points de vente. Des contrôles internes sont aussi accomplis par le techniciens d'Ovired. La certification de produit (viande d'agneau) est accordée à Ovired Calidad SL Marque Valsenda le 18 septembre 2003 (Escuer et Congost, 2003 ; Abad et al., 2005 ; Congost et al., 2005).

Il s'agit d'analyser le système de travail, en cherchant ce qu'on peut améliorer et une fois le système implanté, de procéder systématiquement avec des preuves documentaires. Ce processus qui à première vue semble simple, a eu et continue en présentant des problèmes à résoudre. À partir de ce développement, des éleveurs et des techniciens sont devenus progressivement des entrepreneurs du secteur de la viande. Donc, nous allons décrire ce processus avec tous les moments critiques ainsi que les mesures correctrices appliquées. Le chemin vers la garantie de qualité n'a pas été facile.

En relation avec les contr les d aliment chez les agneaux, on a pris et analysé des échantillons d aliment. On a fait aussi un essaie comparative avec des autres aliments.

b ectifs

Tel que dans la documentation d Ovired Calidad on cherche garantir la qualité complète de la viande d agneau commercialisé dès l origine jusqu au consommateur, par un système de production, tra abilité et étiquetage permettant aux consommateurs d obtenir une information véridique du produit sélectionné, sur la base "une qualité certifiée".

On essaie d établir les règles pour garantir un système de production de viande de qualité.

(i) Développement et application d un système faisable de tra abilité individuelle chez l agneau.

(ii) Certifier tout le processus (fabrique d aliments, exploitations d élevage, abattoir, transport, points d abattage, travaux et vente).

(iii) Améliorer la gestion des exploitations ovines.

(iv) En résumé, conna tre et contr ler chaque facteur de production.

Motivation

Depuis les crises alimentaires jusqu 2001 (vaches folles, dioxines, fièvre aphteuse...) les consommateurs étaient préoccupés mais aussi les éleveurs étaient sensibilisés en découvrant la vulnérabilité de leurs entreprises face ces crises.

Notre préoccupation était que la perception du consommateur sur un produit de très haute qualité de ces exploitations pourrait être modifiée. Nous savons que des ressources naturels (produits fourragers et/o p tures) constituent la base de l alimentation des brebis des exploitations de notre région, mais il s agissait de présenter les plus grandes garanties.

uipe humain

Ovired Calidad SL est une entreprise formée initialement par treize éleveurs d ovin et cinq vétérinaires qui en ce moment étaient les responsables de la santé des exploitations. Ces exploitations se trouvent dans les régions du Bajo Cinca, Cinca Medio et Monegros, comptant avec 10 000 têtes. leveurs et techniciens forment une société avec des objectifs, un cahier de charges accomplir et un protocole de travail pour les obtenir. Tout le processus est soumis un audit par un organisme externe et homologué.

iveau d intervention

Le processus contr ler comprend toutes les phases qui peuvent avoir une incidence sur la vie de l agneau.

Alimentation des agneaux

La composition de l alimentation doit remplir des conditions minimes. On a décidé que l alimentation soit unique pour tous les agneaux de tous les éleveurs dans le programme et exclusive pour les éleveurs de Ovired Calidad.

On fait périodiquement la détermination des déchets fin de garantir la totale absence de

B-agonistes, hormones, corticostéro des, tranquillisants, antibiotiques, sulfamides, absence de farines de sang, de viande, d os et/ou poisson, et de graisses d origine animale.

Le fabriquant choisi doit accepter ces conditions. partir de ce moment, il est en train de recevoir périodiquement des audit externes de l entreprise certifiante ainsi que des analytiques de chaque lot d aliment. Les échantillons sont prises dans exploitations.

Chaque changement de formule, en gardant les conditions requises, est informé par le fabriquant.

Dans quelques audit se sont produites des "no-conformités" avec l aliment. On a étudié sa cause et établi les mesures correctrices correspondantes. Dans le Tableau 1 on décrit les problèmes détectés au sujet de l alimentation des agneaux, le système qui a permit les détecter, le diagnostic, la cause et les mesures correctrices appliquées.

Tableau 1. Incidences chez l alimentation des agneaux

Problème détecté	Système de détection	Cause du problème / Mesures correctrices
Détection de traces de produits thérapeutiques	Prise périodique d échantillons d aliments dans l exploitation, analyse au laboratoire	Le lot d aliment précédente portait des médicaments et n on a pas fait l adéquat nettoyage des trémies
Un pourcentage important d agneaux de plusieurs exploitations n atteint pas le poids de certification aux 100 jours dans plusieurs exploitations	Prise périodique d échantillons d aliments dans l exploitation, analyse au laboratoire. Essaies de croissance des agneaux. Essai comparatif	Important déviation de substances nutritives et composantes de la ration. Réunion de la Direction d Ovired avec les responsables de la fabrication d aliment. Choix de l aliment plus approprié

Conditions minimes des exploitations

Chaque éleveur est responsable d accomplir le programme d autocontr le de l infrastructure de son exploitation ainsi que de la santé des animaux et respecter la réglementation sur le bien-être des animaux, avec la collaboration de l équipe vétérinaire (contr le interne). Les exploitations sont également objet d audits externes qui certifient leur bon état et fonctionnement et dans le cas négatif établissent les mesures correctrices appliquer immédiatement (Tableau 2).

Tableau 2. Incidences dans les conditions minimes des équipements

Problème détecté	Système de détection	Cause du problème / Mesures correctrices
Dans une exploitation déterminée, un pourcentage important d agneaux n atteint pas le poids de certification 100 jours d ge	Révisions des conditions de bien-être des agneaux	Minimiser la vitesse de l aire et l humidité
Ne pas s adapter au ratio : "nr d abreuvoirs/nr d agneaux"	Contr le interne, audits de certification	Emplacement du nombre approprié d abreuvoirs, révision journalière de nettoyage et fonctionnement
Ne pas s adapter au ratio : "mètres d auge/nr d agneaux"	Contr le interne, audits de certification	Suffisante disponibilité d auges
Excès de pertes de crotales	Au moment du chargement	Changement de mailles de séparation, en cherchant la taille de maille adéquate
Traitements sanitaires mal reflétés dans la documentation	Contr le interne, audits de certification	Signaler tous les données du produit utilisé et les dates de début et finales

On fait des audit annuels o au minimum on contr le :

(i) tat des équipements, de fa on garantir le bien-être des animaux.

(ii) Le animaux produits seront élevés exclusivement dans la ferme d origine.

(iii) Sevrage : indépendamment du type d agneau (de P ques ou de lait) et du sexe, le sevrage ne se produira pas avant de 30 jours (vérifié avec une agenda électronique) et 10 kg poids vif (on vérifie le poids systématiquement).

(iv) Interdiction par l Administration des traitements de médicaments les 21 jours préalables l abattage, ainsi que d aliments de médicaments après le sevrage.

(v) Les exploitations d origine des animaux seront qualifiées du point de vue sanitaire comme indemnes la brucellose ou au moins M2. Elles devront respecter le programme sanitaire de la ADS (Association de Défense Sanitaire) correspondante.

(vi) On prendra systématiquement des échantillons de l aliment des agneaux.

(vii) L eau de boisson recevra au minimum le traitement de chloration et on vérifiera sa qualité aux abreuvoirs.

(viii) On fera le contr le du nombre d abreuvoirs et des mètres linéaires d auge et leur distribution.

Bureau central

C est dans le bureau central que la plus grande partie de l information est concentrée.

(i) Les terminaux versent les données de chaque exploitation l ordinateur du bureau d Ovired Calidad SL.

(ii) Les données de l abattoir sont envoyées au bureau d Ovired Calidad SL pour leur traitement, et après rattacher les données de chaque exploitation avec les poids de chaque carcasse, on pratique une dernière validation et on fait la correspondante liquidation.

(iii) Documentation économique.

(iv) Toutes les incidences.

Dans la première phase, on ne pouvait pas évaluer la charge de travail correspondante qui après une année est devenue cruciale dans le processus (Tableau 3). On devra accomplir :

(i) Contr le de tous les données de production. Périodiquement on passe les données l ordinateur du bureau central.

(ii) Administration de toute la documentation du système de qualité.

(iii) Administration de toute la documentation économique.

Tableau 3. Incidences dans le bureau d archives de documentation

Problème détecté	Système de détection	Cause du problème / Mesures correctrices
Charge administrative excessive. Arrêt du processus, délai des liquidations	Les éleveurs étaient payés en retard. Problèmes de coordination	Contrat d un employé

Transport in vivo

Pour l accomplissement de la réglementation on établit des conditions pour le contrat avec un audit. Les échantillons sont prises un jour fixe de la semaine par exploitation et on établit que la route de ce jour sera exclusive pour les éleveurs d Ovired. Le Tableau 4 montre les incidentes dans le transport in vivo.

Tableau 4. Incidences dans le transport en vif

Problème détecté	Système de détection	Cause du problème / Mesures correctrices
Pertes excessives de poids pendant le transport l abattoir	Contr le interne par les éleveurs du poids avant le chargement	Le transporteur élargissait la route

tablissement d abattoir/découpe

On doit aussi accomplir des conditions minimes :

(i) Nés et élevés en origine.

(ii) Abattage pendant les 24 heures suivant la déchargement dans l abattoir.

- Agneaux de lait m les et femelles : ge d abattage 30-45 jours avec 10-14 kg poids vif et 5-7 kg poids de la carcasse.
- Agneaux de P ques m les et femelles : ge d abattage 65-100 jours m les : 23-27 kg (11,4-13,4 kg carcasse) femelles : 21-25 kg (10,3-12,4 kg carcasse).

Après la phase de consultations on a trouvé un abattoir avec les conditions proposées par Ovired Calidad qui acceptait se soumettre au processus de certification. Les incidences détectées dans l abattoir son décrits dans le Tableau 5.

Tableau 5. Incidences dans l abattoir/découpage

Problème détecté	Système de détection	Cause du problème / Mesures correctrices
Problèmes d emplacement et d installation de l antenne de lecture dans l abattoir	cause d être une expérience pionnière et co ncider avec les réformes dans l abattoir	viter des interférences avec des champs magnétiques. Chercher des matériaux compatibles avec la réglementation sanitaire. Connexions étanches
No-lecture d un agneau	Il n y a pas de corrélation avec poids vie	Emplacement de crotale en oreille changée. Provisoire, bouton manuel. Définitif, double antenne et crochets fixes
Lecture répétée d un agneau	Contr le avant d émettre les étiquettes	Fixer un temps d attente (24 s) entre lectures dans le software
Comme garantir le temps d aérer température ambiante	Il n y a pas certitude de l heure finale des travaux sur la carcasse	Il y a évidence de l heure initiale et finale des travaux. On note l heure de la première entrée dans la chambre et de la dernière
uelle est l information intéressante pour le consommateur ?	viter l information exhaustive	Adapter l information dans l étiquette
Comment garder la confidentialité du producteur		Codification des donnée de l éleveur

Transport froid

Réalisé dans un véhicule approprié, avec les documents nécessaires.

Aucun problème a été produit.

La distribution est faite courtes distances.

Point de vente

Les produits la vente devront porter les registres de tra abilité.

Les carcasses certifiées portent la suivante information :

(i) tiquette de marque avec le logotype et le nombre de série individuel.

(ii) Population et ferme de naissance et d élevage.

(iii) ge de l agneau, ainsi que son nombre de management et nombre de sa mère.

(iv) Poids de la carcasse, nombre du lot et ordre d abattage.

Mat riel ui permet la tra abilit che l ovin viande

Identification la naissance

Une partie des éleveurs appartenant au projet initial ont fait pendant des années le contr le de productions, identifiant les reproducteurs avec crotale et avec tatouage ainsi que les agneaux, mais il y avait une perte de 20% des crotales conventionnels, et le travail administratif demandé pour les registres de tra abilité est important. Ainsi, on a étudié toutes les possibilités que le marché et la technologie actuelle présentaient, en concluant que l option idéale est l application au moment de la naissance de l agneau d un crotale avec un microchip de haute fréquence qui peut être réutilisé 10-12 fois.

L éleveur doit disposer d une terminale pour registrer les données de la naissance de l agneau qui sont transférées au micro chip déj placé dans l oreille de l animal. Ces données sont récupérées travers d une antenne de lecture placée dans le point d abattage en les reflétant sur l étiquette qui identifie chaque carcasse avec les données que les Services Techniques d Ovired Calidad considèrent importantes pour l information commerciale ainsi que pour garantir la tra abilité individuelle de chaque animal. Ainsi, les matériaux utilisés sont :

(i) Chips réutilisables de haute fréquence, enregistrables et réutilisables qui se trouvent dans les crotales femelle et sont placés dans l oreille droite de l animal.

(ii) Crotale m le avec le code d exploitation et le nombre de management de l agneau.

(iii) Terminaux de lecture-écriture qui peuvent récolter des donnée des suivantes phases et être consultés pendant le processus : hautes, sevrage, pertes, sortie l abattoir, agneaux de lait, renouvellement.

Le développement et application de ce système implique une inversion importante pour l entreprise qui, après les formalités convenables, a trouvé une ligne d aides par CEDER qu a couvert une partie des dépenses.

Identification au point d abattage

Contr le individualisé, vérification des caractéristiques de chaque carcasse avec le équipement suivant :

(i) Antenne double de lecture de chips l entrée de la ligne d abattage.

(ii) Balance électronique pour la pesée des carcasses, la donnée passe l ordinateur.

(iii) Ordinateur dans l abattoir. Automatiquement et d accord avec le rapport historique, le terminal calcule et valide si l animal remplit les spécifications de la marque pour pouvoir être certifié dans l abattoir, en registrant cette donnée dans le chip et imprimant :

- tiquettes d abattoir.
- tiquette de marque certifiée.

On récupère, lave et désinfecte la partie femelle du crotale pour son recyclage.

Frais du processus Tableau

Tableeau 6. Liste de frais du processus de tra abilité et certification niveau des exploitations et d entreprise de commercialisation

Frais au niveau des exploitations	
Certifications annuelles pour toutes les exploitations	2500 Euros
Tags	2,30 Euros/unité (réutilisables 10 fois)
Terminal	1500 Euros
Frais au niveau de l entreprise de commercialisation	
Personnel (1)	
Employé de bureau mi-temps	581 /mois
Livreur	1458 /mois
Sécurité sociale	1600 /mois
Autres frais fixes (2)	
Location bureaux	103,7 /mois
Location camionnette	299,2 /mois
Location d antenne	223,6 /mois
Transport sur pied	400 /mois
Total frais fixes (1 + 2)	4465,5 /mois
Frais variables	
Taxe abattoir	5,18 /mouton
Découpage	5,00 /mouton

Conclusions

ue représente ce processus pour l éleveur ?

Ce complexe processus, qui affecte tous les niveaux de responsabilité de la production, représente pour les éleveurs :

(i) Rationalité dans la consommation d aliment.

(ii) Application du rendement de chaque exploitation.

(iii) viter le stress du b timent d engraissement.

(iv) On doit réaliser plus d inversions : agenda électronique, crotales avec microchip, amélioration des équipements

(v) L éleveur est obligé être systématique et coordonné avec les autres éleveurs.

(vi) Il faut avoir un bon niveau de formation.

(vii) tre familiarisé avec l autocontr le et les audits externes, en appliquant les mesures correctrices indiquées.

(viii) Et finalement et le plus important, la satisfaction de contr ler les moyens de production, propres ou d autrui. L éleveur se sente intégrant d un équipe qui a parie la sécurité alimentaire.

ue représente ce processus pour le consommateur ?

(i) La garantie qu il est entrain d acheter un produit de qualité totalement confirmée et que, dans le cas hypothétique de présenter quelque problème, peut déterminer l origine et les procès appliqués aux produits de boucherie que le consommateur a achetés.

(ii) u il est prête payer une valeur ajoutée pour un produit de qualité avec une totale garantie.

(iii) La satisfaction de qu on travaille pour remplir ses expectatives.

ue représente ce processus pour l Administration ?

Ce système de travail facilite l Administration le contr le officiel par l audit documentaire des processus et une plus grande efficacité en ce qui concerne la gestion d incidences. Dans ce cas, étant la tra abilité individualisée, on peu déterminer la responsabilité individualisée et pas de forme plus globalisée comme il arrive dans tra abilité par lots.

R f rences recommand es

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Ox meat traceability: Practical implementation using electronic identification and molecular markers

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SUMMARY – An integral control system to assure meat traceability from producers to consumers was developed. After birth, oxen are identified by a ruminal bolus electronic device (transponder) placed in the animal forestomach until slaughter. The registered transponder number identifies the animals during their whole life and after slaughter, it also identifies the carcasses and the commercial retail cuts. To guarantee meat traceability throughout the whole meat chain, a DNA-based control and verification procedure was established and its implementation evaluated. In this work the actions performed to establish the procedure to audit the traceability system are described. In order to create a bank of ox samples, an individual identification card containing the identification data and a blood sample on filter paper was elaborated. Once prepared, the card was laminated and stored at room temperature. The implementation of the control procedure consisted of a comparison between the DNA marker profiles of the meat samples collected anonymously at the butcher's or restaurant, and the DNA markers profiles of the blood on the identification card. This procedure was successfully completed.

Keywords: Traceability, electronic identification, DNA markers, ox.

R SUM – *" ra abilité de la viande de b uf : Mise en uvre pratique en utilisant l identification électronique et les marqueurs moléculaires" Pour assurer la tra abilité de la viande de b uf, on a développé un système intégral de contr le, qui depuis le secteur primaire jusqu à la transformation, permet de garantir la viande qui arrive aux consommateurs. cet effet, l'animal est identifié après la naissance avec un dispositif électronique (ruminal boluses) qui reste dans le rumen réticulum jusqu à ce qu il soit abattu. Le numéro de registre du dispositif est celui qui identifiera l animal vivant, sa carcasse et les pièces. Pour contr ler le système de tra abilité, une procédure de contr le basée sur l identification génétique des animaux (analyse de marqueurs d ADN) a été établie et sa mise en uvre a été évaluée. Dans ce travail, les essais effectués pour établir ce système sont présentés. Dans le but de disposer d'une banque d échantillons des animaux, on a élaboré une carte identificative individuelle en papier de filtre qui contient un échantillon de sang. Cette carte sera plastifiée et conservée à température ambiante. On a évalué la mise en uvre de la procédure de contr le du système de tra abilité en comparant des profils de marqueurs d ADN pour les échantillons de viande rassemblés, d une manière anonyme, che le boucher ou le restaurant et les échantillons de sang conservés dans les cartes d identification. Cette évaluation a été très satisfaisante.*

Mo s s : *ra abilité, identification électronique, marqueurs d'ADN, b uf.*

Introduction

Nowadays, consumer demands for meat products from quality assurance schemes is increasing. For this schemes, traceability is one of the most important tools as it assures the relationship between the animal and the meat cuts through the whole chain of production, transformation, distribution and commercialisation.

In the last years, meat commercialised as certified quality brands, Geographic Protected Identification (GPI), etc., has increased. These brands offer a high quality product very appreciated by the consumer and a guarantee of its origin and production techniques.

The Quality Brand *"Valles del Esla"* was created ten years ago with the goal of producing high quality and guaranteed traceability cattle meat. One of the products of this brand is the ox meat, obtained from Brown Swisse castrated males aged more than four years old. These animals are reared on pasture in the mountains of León (Spain) and fed indoors for a small period of time obtaining a high value product .

For assuring meat traceability from producers to consumers the brand developed an integral control system. After birth, animals are identified by a ruminal bolus electronic device (transponder) placed in the forestomach of the animal until slaughter (Caja *et al*., 1999). The registered transponder number identifies the animals during its whole life and the carcasses and cuts after slaughter.

To guarantee meat traceability and detect possible failures, a control and verification procedure through the whole chain needs to be established. The application of genetic (DNA markers) profiling methods to assure animal and meat traceability has revealed as a useful tool to trace any piece of meat from slaughter to consumer and to link it with the animal identity (Cunningham *et al*., 1999 San-Cristóbal *et al*., 2000 Arana *et al*., 2002). Traceability genetic methods are based on the comparison of genetic information (DNA markers) of the animal biological samples (blood, hair, etc.) with the meat of that animal. To verify "a posteriori" the origin of the meat it is necessary to elaborate a bank of samples for all the animals reared by the brand.

In this work the actions performed to establish the control procedure of the traceability system are presented. The control system will be based in the comparison of the DNA markers profiles between the meat samples and samples of the animals kept in individual identification cards stored in a bank of samples for a period longer than 4 years.

The objectives of the present work were: (i) to choose the biological sample to be analysed and the sample support (ii) to evaluate the effects of different conditions on the DNA sample conservation and (iii) to establish a traceability control system based in the comparison of the DNA molecular markers.

Material and methods

DNA source

DNA from samples of blood, hair and auricular cartilage were extracted and analysed.

Sample support type

Blood samples from 5 different animals were analysed. Three different types of biological sample supports were embeded with blood from the 5 animals:

- Paper A: special filter paper for collection, transport and storage at room temperature during long periods of time.
- Paper B (without treatment): filter paper of 0.5 mm thickness and 250 grs/m^2
- Paper C (with treatment): filter paper similar to B treated with antibiotic 5 l of cloranfenicol solution (3.2 mg/ml) .

The paper was included in the laminated identification card. The identification card is a 125x75 mm laminated cardboard card specifying the information of the animal and the filter paper including the DNA biological sample (Fig. 1).

Handling of the samples

Blood samples were collected and transported to the laboratory in less than 5 h. In the laboratory 100 l of blood of each animal were transferred to the filter paper and dried two hours at 80 C.

Long period sample conservation

Blood samples in the laminated identified card, were treated, separately or simultaneously during seven days with high temperature (60 C) and saturated humidity in order to simulated conditions that can affect blood conservation and card lamination. Analyses were carried out in triplicate.

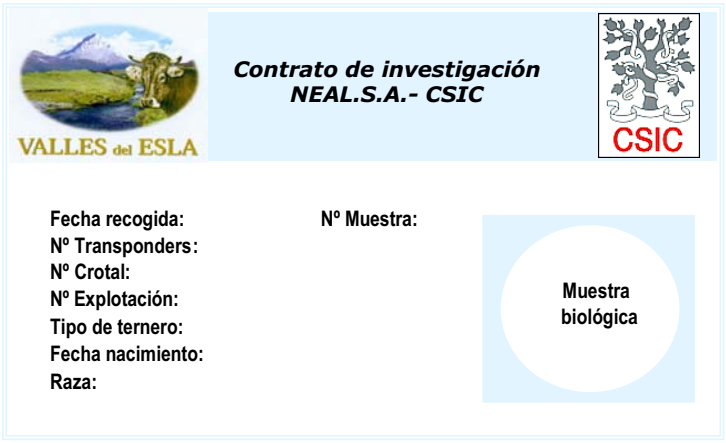

Fig. 1. Animal identification card.

DNA extraction and genetic profile analysis

A small piece (3 mm^2) of filter paper containing the blood sample was introduced in an eppendorff tube. Blood DNA was extracted using a commercial kit following manufacturer recommendations. PCR amplification of 11 molecular markers: BM 1824 and 2113, TGLA 53,122,126 and 227, ETH 3,10, 225 and INRA 23 and SPS 115, were performed using *StockMarks for Cattle Bovine Genotyping it* (Applied Biosystmes). Molecular markers were analyser in a capillary automatic sequencer (ABIPRISM 310, Applied Biosystems) and resulting profiles interpreted by GeneScan Software (Applied Biosystems). Animal genotyping was performed with Genotyper software.

raceability system control and verification

In order to control the traceability system and verify that the genetic identification can be implemented as an audit tool, a bank of ox blood samples was created. This are the "reference samples". Blood samples were incorporated to the animal identification card and was laminated.

In order to have the "verification samples", there were selected six different points of the commercialisation chain (at butcher's or restaurant's). At these points, meat samples were taken out and stored in a freezer (-20 C) until required for analysis. Meat samples were collected in an anonymous way by the brand staff. According to the Sales Department the selected meat samples correspond to 26 oxen identified by its transponder number, then this 26 identifications cards were taken out of the sample bank for analysis of the genetic profile.

Samples (fresh and cooked meat and blood from the identifications cards) were analysed according to the methodology above described. The allelic profiles were compared and relatedness coefficients calculated as indicated by Arana *et al*. (2002).

Results and discussion

Initially, DNA from samples of blood, hair and auricular cartilage were extracted and analysed. Hair samples were rejected to avoid failures and mixtures on sampling. Blood samples are more adequate than cartilage samples because collection of blood samples allows to extend the period of sampling since the cartilage has to be collected when the ear-tag is placed in the animal in order to assure the animal welfare and maximize the efficiency of the process. To avoid contamination of the samples, blood is extracted using a sterile syringe and stored in a vacuum heparinized tube.

Referring to the election of the sample support (different filter papers) for DNA extraction and genetic analysis, DNA molecular markers were amplified and analysed from the three different filter papers tested (Fig. 2).

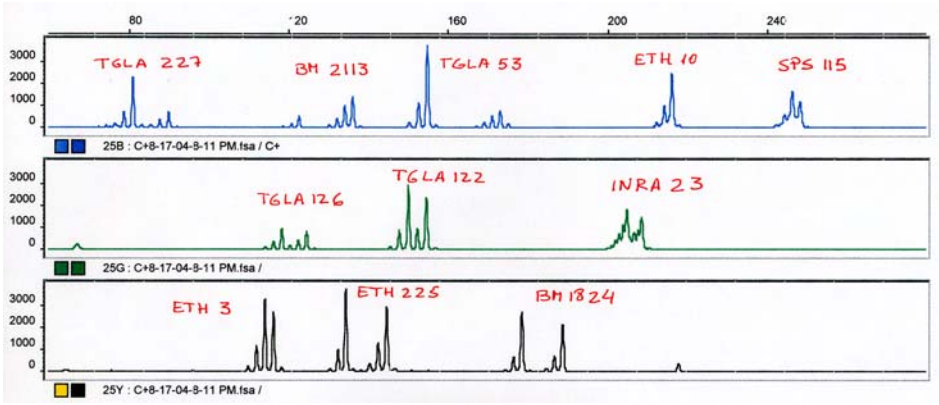

Fig. 2. Eleven DNA microsatellites analysed by Genescan software (Applied Biosystem).

The DNA preservation is an important aspect to be guaranteed for the genetic traceability control system since ox production lasts more than 4 years. Conditions of temperature and saturated humidity during a week did not affect molecular markers analysis. DNA profiles were obtained in these conditions from the three different kinds of supporting papers.

When elaborating a traceability control system the economic aspect is essential. In the proposed traceability system the cost of the identification card, including the filter paper for blood sample, has to be taken into account since all the animals have to be registered with an individual card.

Given that there were not differences between filter papers as DNA conservation is concerned, the election of the support to be used depends on its price. Table 1 shows the cost of an identification card depending on the price of the filter paper utilized to embed the blood sample and the material of the identification card. Identification card A is made in a usual paper card and the filter paper for storing the blood sample is the special filter *Paper A*. Card type B is made in usual paper card and contains the more economic filter *Paper B* to embed the blood. Identification card C is all made in filter *Paper B* and blood is poured directly to a specific place in the card. This last card C was chosen because all the data of the animal can be printed in the card directly from a computer avoiding possible failures in its translation.

Table 1. Economic cost of different identification cards

	Card A (euros/card)	Card B (euros/card)	Card C (euros/card)
Cardboard card	0.0151	0.0151	
Filter paper B card			0.03
Laminated	0.148	0.148	0.148
Sample support: Paper A	1.1125		
Paper B		0.0022	
Total	1.2756	0.1653	0.178

Besides the cost of the identification cards, other costs should be taken into account as related to sample collection process and genetic analysis. The former is difficult to be evaluated since the collection of blood samples is carried out at the same time than other tasks as animal data collection, feed sampling or transponder insertion. Although the cost of the molecular analysis is high (more than 30 euros/sample) it can be assumed because it is an audit tool and only a small number of samples, corresponding to a small percentage of animals, is analysed.

To store all the data of the animals reared and commercialized under this quality brand, a computer database was designed. The identification card is printed directly, from the database

minimizing failures on data transcription. The transponder number of the animal, its administrative ear-tag number, birth date, farm number, animal type and breed, date of blood collection and number of the blood tube were printed in the identification card.

In relation to the implementation of the traceability control and verification system proposed by the brand, the DNA from 6 meat samples collected at the butcher's or at the restaurant and also the DNA of 26 identification cards corresponding to the animals related to the meat samples was extracted and analysed. The genetic profiles of the meat samples were compared with the DNA profile coming from the cards. In all the cases, after computing relatedness coefficients between samples it was verified that every meat sample agrees with one of samples extracted from the identification cards. These results indicates that the implementation of the DNA traceability control procedure was successful and that there is an unique correspondence between the meat and the ox of origin, as guaranteed by this quality brand.

Conclusions

In summary, DNA marker methodology has been shown to be an appropriate approach to establish the origin of a beef cut. DNA based traceability is simple and can be useful for meat to increase consumer's trust and add value to the meat. Its application to the market conditions means that its implementation should have an affordable cost that could be assumed by high quality products.

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Results of the dissection of ripened prosciutto (dry cured ham) obtained from Casertana pig autochthonous ancient genetic type (AAGT)[1]

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SUMMARY – The study was carried out on 26 *prosciutti* (dry-cured hams) obtained from the *Casertana* pig, an AAGT mostly reared in Campania (Italy), with the aim to point out some possible differences due to the sex in linear size and weight parameters detected at the dissection in *pera*, *falsa pera* and *gambo*. The results showed, within the limits of the observation field, that the maximum thickness is higher in the females ($P < 0.05$), as well as the weight of *pera* ($P < 0.05$) and *falsa pera* ($P < 0.05$).

Key words: *Casertana*, autochthonous ancient genetic type, dissection of *prosciutto*.

R SUM – *"Résultats de la dissection de* prosciutto *(jambon sec) affiné obtenu à partir de porcs de l'ancien type génétique autochtone* Casertana *(GAA)". L étude a été conduite sur 26 jambons issus de GAA* Casertana*, élevés principalement en Campanie (Italie), afin de vérifier les éventuelles différences dues au sexe dans les mesures linéaires et dans les paramètres pondéraux décelables à la dissection sur* pera*,* falsa pera *et* gambo*. Les résultats mettent en évidence, dans le domaine d observation, que l'épaisseur maximale est plus grande che les femelles (P 0,0), comme le poids de la* pera *et de la* falsa pera*.*

Mo s s : Casertana*, type génétique autochtone ancien, dissection du* prosciutto*.*

Introduction

In the Italian pig-breeding, *prosciutto* (dry cured ham) represents the product of greater value that covers more than 60% of the commercial value of the side of heavy pork. Even if knowledge from previous studies (Bergonzini and Ferrari, 1980 Baldini, 1986 Zappa *et al.*, 1991) about some factors influencing the quality of "flow diagram" for "typical" *prosciutto* production may be transferred to *sannita* production, the specificity of some phases of the "flow diagram" needs *ad hoc* research.

The traditional processing of the *prosciutto* has very ancient roots, probably going back to the Etrurian who salted the pig hams with a technique increasingly improved up to now. It s known that the *prosciutto* "salting technique" was used, for the first time, by ancient Romans who named the full pig leg, dried by salt and ripened, *perexsuccus* (very dried) from which the current word *prosciutto* derives (Matassino, 2001).

The aim of the present paper is to study the influence of sex within the genetic type in relation to the parameters detected at the dissection of the *prosciutto* obtained by *Casertana* pig AAGT, seasoned for at least 24 months.

[1] Research supported by MiPAF (Ministry of Agriculture Policy and Forestry), by Campania Region and by Benevento Province.

Materials and methods

The study was carried out on 26 *prosciutti* manufactured in a salami making factory in Circello (BN), obtained from 21 castrated males and 5 entire females, belonging to *Casertana* AAGT, reared in multiple boxes at ConSDABI experimental farm, slaughtered at 160 kg of live weight.

After 72 hours of aging, each ham, isolated from the side of pork, was trimmed according to *Napoli* cutting model (Montemurro *et al*., 1974), in order to give at *prosciutto* the characteristic roundish shape known as "chicken leg".

After trimming, the *prosciutto* was subjected to salting process with coarse dry salt (for the lean parts) and wet damped salt (for the pigskin) for a month during this period *prosciutto* was subjected to massages. In the ripening phase (about 9 months), after the salting, *prosciutto* underwent to *stuccatura* (plastering), process that allows to keep tender the *prosciutto* and to give meat flavour. At the 20th month, the *prosciutto* was subjected to the *puntatura* to verify the development of ripening.

The values of the experimental data were corrected for the net live weight of the animal.

The significance of the differences between the estimated mean values was tested by Student s t test.

Results and discussion

Data reported in Table 1 show a greater development of the *prosciutto* obtained from the entire female in comparison with that derived from castrated male ($P < 0.05$), in both maximum thickness (12.90 *vs* 11.04) and in the incidence of the two portions: *pera* (4.96 *vs* 4.04) and *falsa pera* (2.21 *vs* 1.61).

Table 1. *Prosciutto sannita*. Some linear size and same corrected weight parameters obtained during the dissection, distinctly by sex

Parameters	Sex			
	Castrated male		Entire female	
	$\bar{X} \pm \sigma$		$\bar{X} \pm \sigma$	
Linear				
Maximum length (cm)	56.00	3.21	56.20	4.78
Maximum breadth (cm)	29.98	2.54	31.66	1.67
Maximum circumference (cm)	72.06	6.44	76.64	3.34
Maximum thickness (cm)	11.03[a]	1.52	12.90[b]	1.34
Weight				
Fresh weight (iw) (kg)	12.1	2.2	13.7	2.3
Final weight (fw) (kg)	8.6	2.2	10.3	1.7
Trimmed weight (tw) (kg)	7.7	1.9	9.3	1.4
Pera (kg)	4.04[a]	1.1	4.96[b]	0.7
Falsa pera (kg)	1.61[a]	0.6	2.21[b]	0.3
Gambo (kg)	1.13	0.5	1.37	0.5
% loss				
fw/iw	28.9		24.8	
tw/iw	36.3		32.1	
tw/fw	10.5		9.7	

[a,b]P 0.05.

There are no significant differences between sexes for:

(i) The length, the breadth and maximum circumference of the *prosciutto*, even if, certainly, these parameters are influenced by the weight class of *prosciutto* indeed, a study carried out by Fabbri *et al.* (1983), examining data obtained from 504 dry cured hams, pointed out that the length parameter is less noticeable in the "heavy" classes as the weight and adiposity of *prosciutto* oppose to the natural twitch during drying process, while the breadth and the thickness parameters are similar for any weight class.

(ii) Some weight traits done on the *prosciutto*, in agreement with other studies (uadri *et al.*, 1981 Fabbri *et al.*, 1983 Bittante *et al.*, 1991 Gallo *et al.*, 1994).

After 24 months of ripening, the castrated male has an apparent higher per cent loss (28.9%) if compared with entire female (24.8%).

On the *prosciutto*, the entire female has an apparent higher per cent incidence of *pera* (53.63 *vs* 52.24), *falsa pera* (23.88 *vs* 20.79) and *gambo* (14.76 *vs* 14.58), respect to the castrated male.

Conclusions

The results, valid within the limits of the observation field, point out that the entire female has a higher incidence of the noble parts (*pera* and *falsa pera*) in which *prosciutto* is divided, when it is boned.

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Proteomics approach for the definition of a molecular identity card of the traditional meat product fiocco sannita obtained from ancient autochthonous genetic type (AAGT) Casertana pig. Preliminary results[1]

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SUMMARY – The study was carried out on a "typical traditional" product named fiocco sannita, obtained from 12 pigs belonging to AAGT Casertana and ripened for twelve months. In this product Semimembranosus, Biceps femoris, and Semitendinosus muscles represent about ~ 31, ~ 27 and ~ 42%, respectively. The definition of the muscular protein has been achieved by the proteomics approach. The myofibrillar and sarcoplasmatic proteins were previously fractionated. The profile of the two protein fractions was evaluated, at the end of ripening, by analytical procedures such as 2-DE and MS-MALDI-TOF. Quali-quantitative analysis, within limits of the observation field, highlighted: (i) a remarkable complexity, in addition to the main sarcoplasmatic and miofibrillar proteins, due to some of their multiple isoforms and fragments; (ii) a heterogeneity of two proteins, α-actin and DJ-1; and (iii) a high individual variability. The proteomics approach proved a useful tool for the characterization of this "typical traditional" product.

Key words: Casertana, fiocco sannita, mass spectrometry, proteolysis, ancient autochthonous genetic type.

RESUME – "Approche protéomique pour la définition de la carte d'identité moléculaire du produit carné traditionnel fiocco sannita, obtenu à partir de porcins de l'ancien type génétique autochtone (TGAA) Casertana. Résultats préliminaires". La recherche a été conduite sur un produit "traditionnel typique" dénommé fiocco sannita issu de 12 porcs du type génétique autochtone ancien (TGAA) Casertana. Le fiocco sannita est composé des muscles Semimembranosus, Biceps femoris, et Semitendinosus dans la proportion de ~ 31, ~ 27 et ~ 42%, respectivement. La définition des protéines musculaires a été réalisée selon une approche protéomique. Les protéines de la fraction soluble dans l'eau et de la fraction saline soluble ont été préalablement fractionnées. La définition du profil protéique, après un temps d'affinage de douze mois, a prévu l'emploi de techniques telles que l'électrophorèse bidimensionnelle couplée à la spectrométrie de masse MALDI-TOF qui ont mis en évidence, dans le domaine d'observation : (i) une considérable complexité ; (ii) une hétérogénéité pour deux protéines, α-actine et DJ-1 ; et (iii) une variabilité individuelle élevée. L'étude protéomique s'est révélée un moyen très utile pour la caractérisation de ce produit traditionnel typique.

Mots-clés : Casertana, fiocco sannita, spectrométrie de masse, protéolyse, type génétique autochtone ancien.

Introduction

The characterization of products of animal origin represents an essential step for their achievement and safeguard.

The proteomics analysis through very innovative tools, such as two-dimensional electrophoresis (2-DE) at high resolution, image analysis and mass spectrometry MALDI-TOF, allows the characterization of complex patterns of the expressions and turnover of cell proteins. Its application in

[1] Research supported by MiPAF (Ministry of Agriculture Policy and Forestry), by Campania Region and by Benevento Province.

food sector has allowed the individuation and identification of molecular markers (biomarker) and the achievement of a standard map for the characterization of final product. These biomarkers might be used for optimization of meat production and conservation. Moreover, together with other traditional quality parameters (physical, chemical-physical, physiological and chemical), they contribute to the definition of nutritional and extranutritional traits and to the individuation of territorial specificity. The constitution of a bioimages database, from two-dimensional maps of traditional product proteins, was used as collection of fingerprintigs of the product above mentioned.

Fiocco sannita, similarly *prosciutto*, derives from pork leg but, unlike the latter one, has been boned and trimmed in order to obtain the typical shape. From the processing point of view it represents an interesting product because after salting, common to *prosciutto*, it will be conserved into bowels, rigorously swine, this latter tipic of fermented salami. In this case, the microbial flora develops only in the periferic area of the product, as reported by Sarra *et al.* (2004). *Fiocco sannita* was obtained from a AAGT *Casertana*, known since from ancient times and defined by Hoesch (first half of sec.) "Italian swine pride". For this AAGT, present nowadays mainly in Campania (Italy), a wide recovery programme is in progress and this research is part of this programme, contributing to the achievement of products derived from meat of these pigs.

Materials and methods

The samples were collected from three muscles (*Semimembranosus*, *Biceps femoris*, and *Semitendinosus*) of each *fiocco* and analyzed separately. For the extraction of sarcoplasmatic fraction, muscle tissue (5 g) was homogenized into 20 ml of phosphate 10 mM buffer at pH 7.0 myofibrillar fraction was extracted from homogenized muscular residue, using denaturing and reducing buffer (4% CHAPS, 8 M urea, 65 mM DTT).

The first dimension was performed by Ettan IGPhor II (Amersham-Pharmacia Biotech) using Immobiline DryStrips gel pH 3-10NL (18 cm) for the sarcoplasmatic fraction, and Immobiline DryStrips gel pH 4-7 (18 cm) for miofibrillar one. The two-dimensional electrophoresis gel (2-DE) was performed by an Ettan Twelve System (Amersham-Pharmacia Biotech).

The second dimension was performed according to O Farrel procedure (1975), on an electrophoretic gel constituted of a gradient of pores (T = 9-18% C = 2.5).

The two-dimensional map was scanned for image analysis by a Typhoon 9210 (Amersham-Pharmacia Biotech). The spots, detected from image analysis and appropriately selected, were digested *in situ* with tripsina, according to Shevchenko *et al.* (1996), and the triptic digests were analyzed by mass spectrometry MALDI-TOF (Amersham-Pharmacia Biotech).

The peptidic sequencing was performed by using the CAF-PSD methodology (Chemically Assisted Fragmentation – Post Source Decay).

Results and discussion

Figure 1 shows a 2-DE map of the sarcoplasmatic protein fraction in which was highlighted the presence of the myofibrillar protein tropomyosin, as previously reported by di Luccia *et al.* (2005), essentially due to the use of sodium chloride during salting. In this figure emerges the absence of creatin kinase, while other sarcoplasmatic proteins are almost all identifiable (Matassino *et al.*, 2004 di Luccia *et al.*, 2005). In this latter case, 2-DE map is very similar to that one obtained from proteomic study on *prosciutto* ripened.

Figure 2 shows a 2-DE map of the myofibrillar protein fraction, in which is evidenced the deep proteolysis interesting particularly myosin light chains. In the miofibrillar 2-DE map were detected proteins such as: (i) tropomyosins (ii) fragments of myosin heavy chain (iii) actin and (iv) myosin light chain (MLC1 fast and slow, MLC2 fast and slow, MLC3).

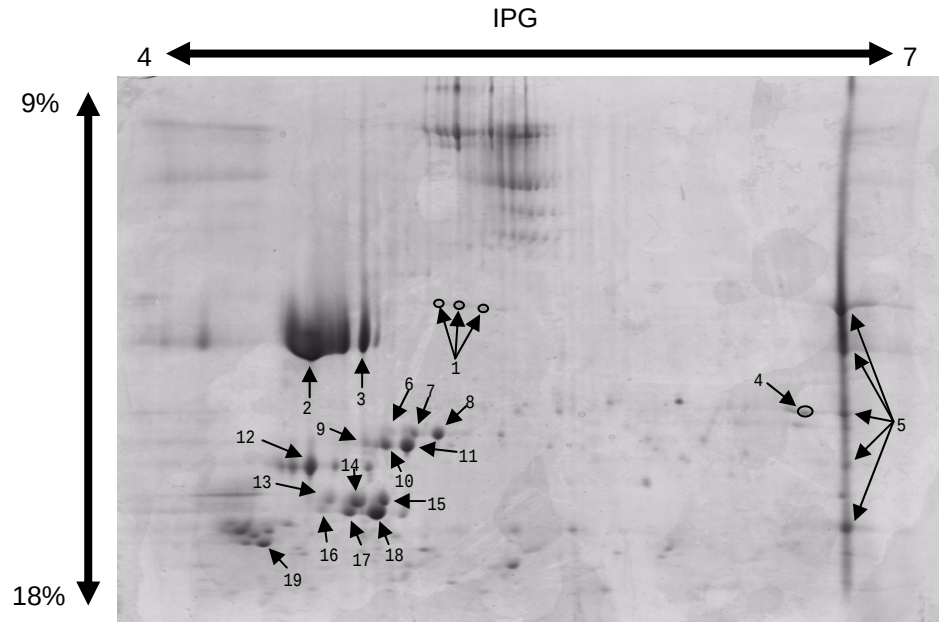

Fig.1. 2-DE map of sarcoplasmatic protein fraction of *fiocco*.

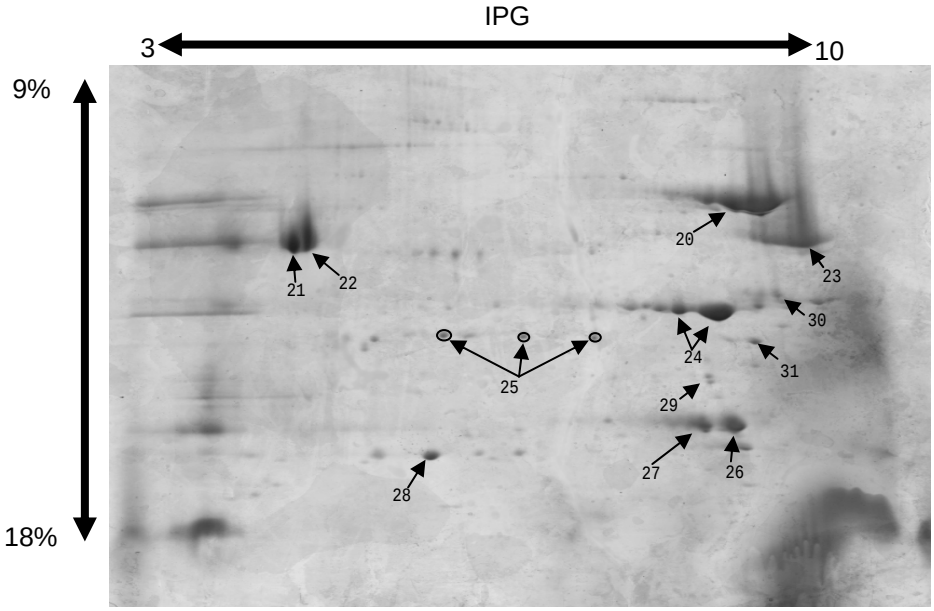

Fig. 2. 2-DE map of miofibrillar protein fraction of *fiocco*.

Table 1 summarizes the peptidic map of identified spots by mass spectrometry MALDI-TOF.

Moreover two-dimensional analysis of the two protein fractions showed a polymorphism for two proteins: (i) actin (myofibrillar protein) and (ii) DJ-1 (sarcoplasmatic protein that would have an important function in neuronal metabolism, with particular regard to Parkinson prevention (Abou-Sleiman *et al.*, 2003).

Both these proteins were identified by mass spectrometry MALDI-TOF and confirmed by peptidic sequencing 1334 Da (Fig. 3) and 1811.85 Da (Fig. 4), respectively.

Table 1. Identification of the protein from pork skeletal muscles by MALDI -TOF mass spectrometry

Spot	Identified protein	Spot	Identified protein
1	Actin	17	Myosin light chain 2 fast
2	β-Tropomyosin	18	Myosin light chain 2 fast
3	α-Tropomyosin	19	Myosin light chain 3
4	Triosephosphate isomerase 1	20	Enolase
5	Fragments of myosin heavy chain	21	β-Tropomyosin
6	Myosin light chain 1 slow	22	α-Tropomyosin
7	Myosin light chain 1 slow	23	Aldolase
8	Myosin light chain 1 slow	24	Triosephosphate isomerase
9	Myosin light chain 1 fast	25	DJ-1
10	Myosin light chain 1 fast	26	Chain A mioglobyn
11	Myosin light chain 1 fast	27	Myoglobin
12	Myosin light chain 2	28	Fatty acid binding-protein
13	Myosin light chain 2 slow	29	Low density lipoprotein
14	Myosin light chain 2 slow	30	Carbonic anhydrase
15	Myosin light chain 2 slow	31	Superoxyde dismutase
16	Myosin light chain 2 fast		

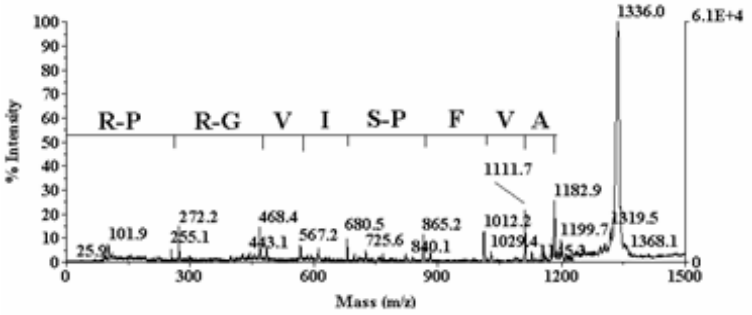

Fig. 3. CAF-PSD spectra of 1334.57 Da peptide from actin parent protein.

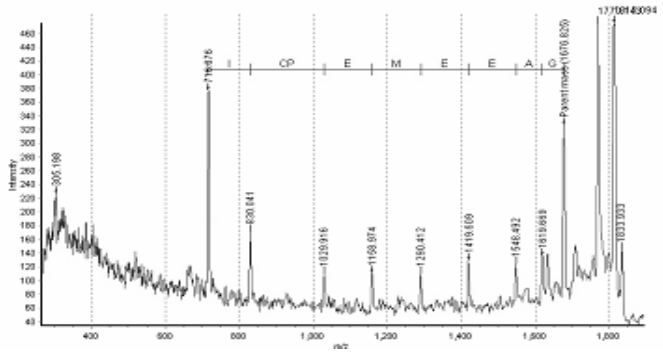

Fig. 4. CAF-PSD spectra of 1811.857 Da peptide from DJ-1 parent protein.

Both the proteins are present into three multiple isoforms that differ each other for the values of isoelectric point. Analysing international literature, at our knowledge, the polymorphism of the DJ-1 and actin would be detected for the first time in pork ripened meat (Matassino *et al.*, 2004, 2005). The heterogeneity observed might be explained considering the spots, related to the two proteins, as

expression of a polymorphism of *loci*, seat of polypeptides encoding DNA segments (genes) or as a result of post-translational modification that originates a different level of phosphorilation.

Moreover, in myofibrillar protein fraction of *Semitendinosus* muscle (Fig. 5), from 137 to 458 spots were detected, only 17 of which matched to the different individual maps the relative volume (%) of the 17 matched spots highlightes a high variability (24-83) expressed as cv (%).

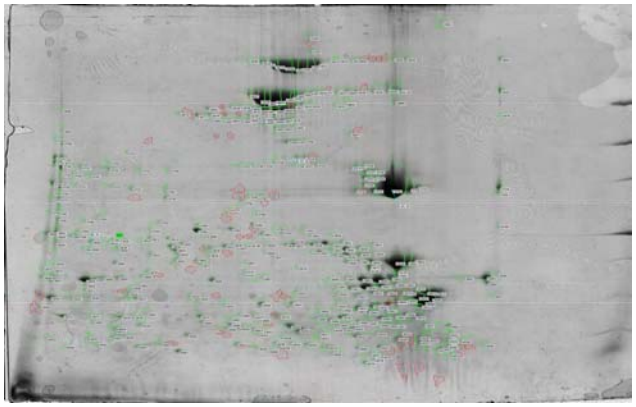

Fig. 5. 2-DE map of myofibrillar protein fraction of semitendinosus muscle.

Conclusions

The polymorphism evidenced by two-dimensional maps for the actins and DJ-1 might be an element of products differentiation from obtained from other genetic types of pork meat.

By image analysis 2-DE standard maps might be obtained, which can give indications for the optimization of the length of ripening, as well as to achieve information for the improvement of the conditions of some steps in the flow diagram. These maps constitute also a term of comparison in order to verify the presence of some typicality and healthy indicators of a product.

Probable discordances between the product map under examination and that one present in a database might be index of factors regarding:

(i) uality and typicality of product:

- Product of imitation.
- Different conditions of ripening of raw materials processed.
- Origin, due to the traditions of flow diagram of a territory or of a specific geographical area.

(ii) The healthy of the product:

- Anomalous fermentations due to a not desired pollutant or pathogenic bacteric flora.

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The Mallorca Black pig: Production system, conservation and breeding strategies

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SUMMARY – From 1997, the "Mallorca Black pig" is recognised as an autochthonous endangered extensive pig breed by the Spanish Ministry of Agriculture, Fisheries and Food. In the present situation, close to 80 extensive farms with more than 1300 reproducers are recovered by the "Mallorca Black Pig Association". These animals are managed in extensive conditions and the feeding regime is based on pasture, cereals, legumes, figs, almonds, acorns and Mediterranean shrubs. A continuous evaluation of new reproducers (electronic identification, DNA traceability, reproductive and productive traits recording and morphological standard appraisal) and across farms genetic exchanges (via auction sales) are basic elements of the conservation and improvement programme set up by IBABSA and IRTA. Apart from the production of piglets for consumption at a low weight ("porcella"), growing animals are slaughtered at heavy weight (120-180 kg) and are used to obtain spiced typical sausages ("*sobrasada*"). Production, reproduction and carcass characteristics are under investigation to improve efficiency without a reduction on meat and traditional product quality.

Key words: Mallorca Black pig, conservation, improvement, quality.

R SUM – *"Le porc Noir de Mallorca : Système de production, stratégies de conservation et d amélioration". Depuis 1997, le "porc Noir de Mallorca" est reconnu comme une race autochtone extensive menacée par le Ministère Espagnol de l Agriculture, de la P che et de l Alimentation. A l heure actuelle, près de 80 fermes en extensif avec plus de 1 00 reproducteurs adhèrent à l Association du Porc Noir de Mallorca. Ces animaux sont exploités dans des conditions extensives et leur régime alimentaire est basé sur le p turage, et les céréales, légumes, figues, amandes et glands. Une évaluation en continu des nouveaux reproducteurs (identification électronique, tra abilité par ADN, enregistrement des performances reproductives et productives, évaluation morphologique suivant le standard de la race) et les échanges entre fermes (par la voie de la vente aux enchères) sont les éléments de base d un programme de conservation et d amélioration établi par IBABSA et IR A. Mis à part la production de porcelets consommés entiers à un faible poids ("*porcella*"), les animaux sont abattus à des poids élevés (120 180 kg) et utilisés pour la production d un type spécial de saucisse très épicée ("*sobrasada*"). Les performances de production, reproduction et carcasse sont analysées dans l objectif d améliorer l efficacité sans une diminution de la qualité de la carcasse et des produits traditionnels.*

Mo s s : *Porc Noir de Mallorca, conservation, amélioration, qualité.*

istory and present situation

Several archaeological sites indicates the presence of pigs in the Balearic Islands before the roman and vandal dominations. It seems probable an Iberian peninsula origin but several other Mediterranean pig breeds introduced by different civilisations contributed to his establishment (Torrens, 1947 Sañudo, 1994). The Arabian domination, the effect of diseases (as African swine fever) and, recently, the introduction of leaner pig breeds and intensive production systems are the major factors of the decline of this autochthonous pig breed. Black skin and fatness are common traits of the Mallorca Black pig with some strains of Iberian pigs distributed along Spanish and Portuguese extensive areas (Payeras, 1988 Payeras and Falconer, 1998). Preliminary studies on the mitochondrial haplotypes of b citocrome reveals a close relationship with other European breeds and far from the Asiatic and Middle East pig breeds.

The Mallorca Black Pig Association was founded and the breed herd book established in 1997. This association receives the technical support of IBABSA, a service of the Balearic Government, to preserve, improve and promote the breed.

At present, 121 boars and 1329 females are recognised as Mallorca Black pig reproducers in the

herd book. The population is fragmented in small herds (79) with an average of 20 reproducers each (Table 1), sex ratio (males/females) in nucleus herds is close to 10% and only a reduced number of farms distributes male reproducers to other herds. Consequently the efective genetic population is lower than real figures.

Table 1. Statistics of Mallorca Black Pig Herd book

Year	Total reproducers	Sows	Boars	Farms
1998	447	409	38	30
2000	730	656	74	50
2002	908	817	91	85
2004	1102	989	113	91
2005	1440	1329	121	79

roduction system

The Mallorca Black pig is managed in extensive conditions (25 pigs/hectare) as a complementary agricultural activity in family farms (Fig. 1). Because of the extensive production system, males and females remains together and matings are difficult to be controlled. In some cases the paternity of young piglets is uncertain and free piglet adoptions is not uncommon between sows (Jaume, 2000).

Fig. 1. Extensive production conditions.

Feeding regime is based on pasture, cereals (barley and rye), legume seeds, figs, almonds, acorns, and several Mediterranean shrubs. Aside of natural feeding resources sows are feed with commercial diets during lactation and pregnancy. Additionally growing pigs to slaughter are supplemented with barley and green peas.

Reproduction figures are similar to other extensive breeds (Dobao *et al*., 1988). The litters per sows per year is close to 2 and the average number of piglets weaned per sow and year is nearly 12 (Table 2). A large variability is observed in reproductive traits and the management conditions have a large influence in this parameters. Lactation period is usually over 4 weeks and in some cases young piglets (close to 8 kg live weight) are removed and consumed as "*porcelles*".

Table 2. Reproduction traits in Majorcan Black pigs

Piglets/litter	Average	SD
Total born	7.9	2.62
Born alive	7.5	2.45
Alive at 1 week	6.1	2.35
Piglets weaned	6.0	2.35

Traditional growing period is longer than 12 months and the minimum live weight accepted to produce "*sobrasada*" is 120 kg. Males to be slaughtered are castrated at a young age. Average daily gain, despite of the extensive conditions of production, is close to 600 g/day from 25 to 65 kg live weight (Table 3).

Table 3. Average daily gain (g/day) in different test periods for females and males retained in the Mallorca Black Pig Association (November 2005 Auction Sale)

Sex		Period 1	Period 2
Female	Weights (kg)	14-24	24-59
	ADG (g/d)	392(40)†	598(80)†
Males	Weights (kg)	17-28	28-64
	ADG (g/d)	417(49)†	627(70)†

†Standard deviations in brackets.

Morphological traits

Main characteristics of this breed are in accordance with other western Mediterranean pig breeds: black colour (or slate-grey) and high percentage of fat tissue (as most strains of Iberian pigs). The traditional morphological characteristics established in the herd book of the Mallorca Back Pig are: (i) slate-grey skin colour (ii) concave nose profile (iii) tassels in the neck base and (iv) large and pendulous ears.

Size of adult animals is moderate (150 kg) and the average number of functional teats is 10.61. Animals with white spots, leg weakness, non horizontal back profile, less than 10 functional teats or conformed hams are not inscribed in the herd book in order to maintain basic morpho-functional standards (Figs 2 and 3).

Fig. 2. Mallorca Black pig boar.

Fig. 3. Mallorca Black pig female.

Conservation program and breeding strategies

In the present situation all animals are identified with tattoo and electronic ear tags and an specific information system, including full reproduction data of the nucleus herds, are managed by IBABSA to provide advice to the Mallorca Black Pig Association. Biological samples are obtained from new reproducers, included in the herd book and tested, in order to estimate the genetic variability using DNA analysis. Twelve microsatellites located in 11 different chromosomes, previously described in literature, are currently analyzed to verify the parentage and identification of individual animals in these porcine populations.

Conservation programme is based on a limitation of the number of young females retained per sow and boar and with a continuous exchange of genetic material across herds in order to avoid an increase of inbreeding rates.

In the last year (2005) 439 new sows from 121 different boars and 230 sows contributed to replace the 1329 adult sows in all herds. Replacement rate is 33%. No more than 2 young sows from the same mother are accepted in the herd book per year and an average of 3.6 young sows per boar are used yearly to replace culled ones. In the present situation all boars contributed to the replacement with at least one young sow.

Table 4. Conservation program statistics in 2005 year

New sows culled per boar	Number of boars	Total number of culled new sows	Culling rate
1-2	31	46	10.5
3-5	64	134	30.5
6-10	17	119	27.0
11-23	9	140	32.0
Total	121	439	

Carcass and meat charateristics

Aside of the consumption of roasted piglets with an average carcass weight of 8 kg "*porcella*" (mainly in winter time), most of the traditional high quality products in the Balearic Islands are based on Mallorca Black pig ("*sobrasada*", "*botifarrons*").

The most important product is "*sobrasada*" (Fig. 4) a type of highly seasoned sausage with paprika, pepper and salt with a texture similar to "batter". All cuts of the carcasses are used to produce "*sobrasada*" but flare fat ("*saim*") could be used in the confectionery of special sweet cakes ("*ensaimada*").

Fig. 4. *"Sobrasada"*.

Main cuts as loin, terderloin, shoulder and ham are less than 30% of he hot carcass weight (Fig. 5) and fat represents more than 46% of the carcass carried about with all the main cuts, additional ones (as double chin, abdominal and back, kidneys, liver, lung) and blood are used to produce "*sobrasada*". Preliminary results of intramuscular fat content in the loin ranges from 5 to 10%, like in Iberian pigs, and an specific use of this cut to produce dry cured loin will be investigated. Several meat characteristics (pH, water holding capacity, color and fatty acids composition) and sensory traits will be analyzed at the IRTA Meat Technology Center.

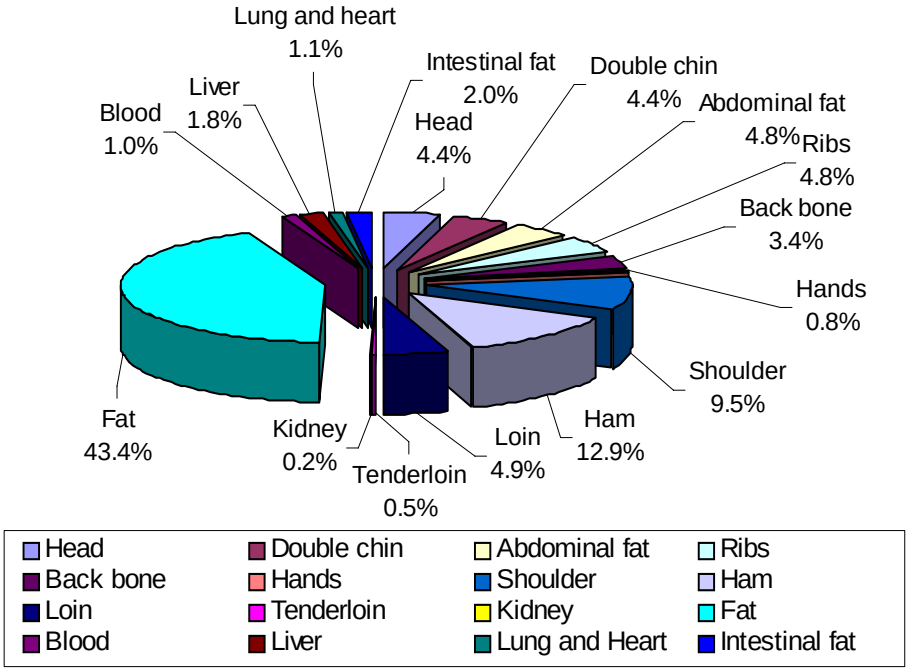

Fig. 5. Distribution of the carcass cuts in Mallorca Black pigs.

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The growth rate and carcass quality of lambs of Zelaznenska sheep reared in different maintenance conditions[1]

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SUMMARY – The experiment has been carried out on 78 lambs of Zelaznenska sheep. Ewes and their lambs were divided into two groups. Group I during the rearing period has been kept under an umbrella roof, group II in a barn. The growth rate of lambs has been estimated and ultrasonic measurements of m.l.d. muscle and carcass quality of 20 ram lambs have been made. The results obtained showed that environmental conditions did not significantly negatively affect body weight growth, however caused an unimportant reduction of subcutaneous fat thickness and meatiness of the loin part of the lamb's body. Maintenance under the umbrella roof contributed to carcass quality improvement, which has been proved by a significantly higher lean meat content in the hind leg.

Keywords: Sheep, maintenance conditions, growth rate, carcass quality.

RESUME – "La vitesse de croissance et la qualité bouchère de carcasses d'agneaux de la race polonaise de plaine, variété Zelaznenska, tenus dans différentes conditions d'élevage". Les recherches ont été effectuées sur un troupeau de 78 agneaux mâles et femelles Zelaznenska. Les mères avec des agneaux ont été partagées en deux lots. Au cours de l'élevage le groupe I était tenu sous hangar, tandis que le groupe II était élevé en bergerie. L'analyse de la vitesse de croissance des agneaux et la mesure du muscle L.d. faite par ultra-sons ont été effectuées, ainsi que l'analyse de carcasse de 20 agneaux mâles. On a constaté que les conditions d'élevage n'avaient pas d'impact significatif sur le poids et la vitesse de croissance des agneaux. Par contre, ces facteurs ont contribué à la faible réduction d'épaisseur de la graisse de couverture et à la meilleure musculature de la partie dorsale-lombaire. L'élevage sous hangar a contribué à l'amélioration de la qualité de carcasse ce qui est prouvé par la teneur significativement supérieure en tissus musculaires du gigot.

Mots-cles : Moutons, conditions d'élevage, vitesse de croissance, qualité de carcasses.

Introduction

Zelaznenska type of Polish Lowland sheep is the local breed maintained under "National program of conservation genetic resources of domestic animals" (Ministry of Agriculture and Rural Development, 2000). That breed is characterized by high reproductive performance. The average lifetime fecundity expressed as number of lambs weaned per ewe per year number reach 1.5. That's why Zelaznenska sheep is considered as good maternal component to slaughter lambs production (Kuznicka at al., 2005). Also there is possibility to utilize local breeds of sheep to landscape conservation and grazing on waste land, which is connected with extensive production system. In relation to above mentioned the aim of presented study was estimation of meat performance of zelaznenska lambs reared in different maintenance conditions.

Materials and methods

The experiment has been carried out on 78 ewe and ram lambs of Zelaznenska sheep. Ewes and their lambs were divided into two groups. Group I during the rearing period has been kept under umbrella roof, the group II in barn. All animals were fed farm produced fodder according to standards. From the 2nd week of life lambs had free access to crushed oat and hay. The lambing season took

[1]The investigations realized in the frame of scientific project No. 2 P06Z 020 26, sponsored by State Committee for Scientific Research.

place on the turn of February and March when air temperature dropped below 0 C. The lambs were weighted after birth and than in 3 week intervals. On the base of weighing the body weight at birth and at the age of 28th, 56th and 100th has been estimated. Also the growth rate between mentioned above periods was calculated. At the 100th day of life the ultrasonic measurements of *musculus longisimus dorsi* (m.l.d.) on the last thoracic vertebrae has been performed using 5 MHz transducer. After the weaning (at the age of 100th days) lambs from both groups has been kept at the same conditions as during the nursing period.

At the age of 120 days 10 ram lambs from each group were slaughtered to carcass quality estimation using methodology given by National Research Institute of Animal Production (Nawara *et al*., 1963).

The results has been calculated by variance analysis method using SPSS 12.0 software (2003).

Results

The lambs reared in barn obtained 400 g higher average birth weight in comparison to these from umbrella roof, while at the weaning that difference raised up to 700 g. In both groups the distribution of lamb s sex and litter size was similar. Initially lambs from group I achieved higher growth rate, but at the period between 56th and 100th day of life lambs reared in barn grew faster. All mentioned above differences were small and statistically insignificant (Table 1). Presented results were similar to these obtained in previous study conducted on Zelaznenksa type lambs reared in barn (Rant and Niznikowski, 2003).

Table 1. Body weight growth and daily gains of lambs reared in different maintenance conditions

Traits	Umbrella roof (Group I)		Barn (Group II)	
	Mean	S_E	Mean	S_E
Birth body weight (kg)	4.92	0.15	5.32	0.17
Body weight at 28th day (kg)	12.53	0.32	12.75	0.36
Body weight at 56th day (kg)	19.28	0.61	19.21	0.69
Body weight at 100th day (kg)	26.30	1.02	26.99	1.16
Daily gains between 1st and 28th day of life (g/day)	281.67	9.99	275.45	11.34
Daily gains between 1st and 56th day of life (g/day)	261.10	10.37	252.56	11.77
Daily gains between 28th and 56th day of life (g/day)	241.28	12.41	230.49	14.08
Daily gains between 1st and 100th day of life (g/day)	215.93	10.14	218.94	11.51
Daily gains between 28th and 100th day of life (g/day)	191.28	11.92	197.75	13.52
Daily gains between 56th and 100th day of life (g/day)	159.46	15.23	176.92	17.29

Ultrasonically measured m.l.d muscle depth and area were statistically significant higher in group of lambs reared in barn (Table 2). The differences in fat thickness over m.l.d muscle has not been found. Obtained results, regarding subcutaneous fat thickness and m.l.d. muscle area, achieved lower values compared to these reported by Rant and Niznikowski (2003) where 3.5 MHz transducer has been used.

The carcass quality analysis of ram lambs showed significantly larger hind leg circumference and higher values of other carcass measurements in group II what suggests better carcass conformation in that group (Table 3). However, highly significantly greater hind leg weight and its content in half carcass indicate higher carcass quality of ram lambs reared under umbrella roof. Also that was confirmed by significantly higher meat weight at that group after hind leg dissection. Although statistical differences has not been found in dissected fat weight the carcasses of ram lambs from group I were characterized by over 2% lower fat content in hind leg. Significantly higher meat and

lower fat content in hind led dissection has been reported also by Markiewicz and Gruszecki (2004).

Table 2. Life ultrasonic measurements of m.l.d. muscle of lambs reared in different maintenance conditions

Traits	Umbrella roof (Group I)		Barn (Group II)	
	Mean	S_E	Mean	S_E
Fat thickness over m.l.d muscle (mm)	1.22	0.05	1.28	0.05
Muscle depth (mm)	19.35	0.33	20.54*	0.38
Muscle width (mm)	40.55	0.71	40.76	0.81
Muscle area (cm^2)	5.81	0.16	6.27*	0.18

*Statistical significance at P≤0.05.

Table 3. Carcass characteristic of ram lambs reared in different maintenance conditions

Traits	Umbrella roof (Group I)		Barn (Group II)	
	Mean	S_E	Mean	S_E
Carcass measurements				
Hind leg length (cm)	24.62	0.41	25.25	0.41
Hind leg deepness (cm)	17.92	0.32	18.36	0.32
Hind leg circumference (cm)	34.85	0.39	36.07*	0.39
Hind leg tightness index (%)	141.54	2.17	143.13	2.16
Fat thickness over m.l.d. muscle (mm)	0.81	0.09	0.97	0.09
M.l.d. muscle width (cm)	5.42	0.14	5.44	0.14
M.l.d. muscle depth (cm)	2.47	0.08	2.56	0.08
Weight and contents of cuts in half carcass				
Hind leg weight (kg)	1.63**	0.02	1.55	0.02
Hind leg content (%)	28.27**	0.28	26.85	0.28
Loin weight (kg)	0.38	0.01	0.40	0.01
Loin content (%)	6.70	0.22	6.92	0.22
Best end neck weight (kg)	0.37	0.01	0.37	0.01
Best end neck content (%)	6.38	0.18	6.45	0.18
Valuable cuts weight (kg)	2.43	0.04	2.36	0.04
Valuable cuts content (%)	41.95	0.51	40.80	0.50
Hind leg dissection				
Fat weight (kg)	0.18	0.02	0.21	0.02
Fat content (%)	10.57	0.91	12.80	0.90
Meat weight (kg)	1.17*	0.03	1.05	0.03
Meat content (%)	70.78	1.67	67.97	1.66
Bones weight (kg)	0.32**	0.01	0.28	0.01
Bones content (%)	19.76	0.51	18.44	0.51

*Statistical significance at P≤0.05; **Statistical significance at P≤0.01.

Probably lambs kept under umbrella roof had higher nutrient requirements and higher energy expenditure, despite of slower growth rate, caused lower fat tissue deposition and higher lean content in hind leg, which is working muscle (Kuznicka, 1997; Lawrence and Stibbards, 1990; Sormunen and Antila, 1987).

Conclusions

Environmental conditions did not significantly effected decreasing of body weight growth, however caused unimportant reduction of subcutaneous fat thickness and meatiness of loin part of lamb s body. But maintenance under umbrella roof contributed carcass quality improvement what has been proved by significantly higher lean meat content in hind leg.

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The role of Producers' Associations in the valorisation of traditional products: An Italian North-West poultry and rabbit breeds Consortium

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SUMMARY – The valorisation of traditional methods of production can be useful not only for the survival and recovery of local breeds but also for economic purposes and to guarantee higher incomes to breeders interested in a more sustainable livestock production. To achieve such objectives requires time and money to support the breeders, as well as an organized structure to market and promote the products. The amount of local breeds still reared in Italy is few in number: in the North West (Piemonte region) there are only two poultry breeds (the Piemontese Fawn Hen and the Saluzzo White Hen) and one rabbit breed (the Carmagnola Grey Rabbit). After years devoted to increasing the numbers of these animals as well as improving their productive performances, now a Producers' Association has been established to improve the marketing strategies for these three breeds.

Key words: Meat products, local breeds, Piemontese Fawn Hen, Saluzzo White Hen, Carmagnola Grey Rabbit.

R SUM **–** "Le rôle des Associations de Producteurs pour la valorisation des produits traditionnels : Un Consortium du Nord-Ouest de l'Italie pour les races de poulets et de lapins". La valorisation des productions traditionnelles est utile non seulement pour la survie et la sauvegarde des races locales mais surtout pour des motifs économiques et pour garantir de meilleurs revenus aux éleveurs qui réalisent une production plus durable. Pour la réalisation de ces objectifs il est nécessaire de disposer de temps et de fonds pour aider les éleveurs, et en même temps d'une structure organisationnelle pour commercialiser et faire connaître les produits. Concernant les poulets et lapins, les races locales aujourd'hui élevées sont peu nombreuses : dans le Nord-Ouest de l'Italie (Région du Piémont) il y a seulement deux races de poulets (Poule Blonde du Piémont et Poule Blanche de Saluzzo) et une race de lapins (Lapin Gris de Carmagnola). Suite aux années consacrées à augmenter le nombre et les performances productives de ces animaux, a été fondée aujourd'hui une Association de Producteurs concernant ces trois races pour améliorer les stratégies de commercialisation.

Mo s s : Produits d'origine animale, races locales, Poule Blonde du Piémont, Poule Blanche de Saluzzo, Lapin Gris de Carmagnola.

Introduction

The survival and rescue of local breeds, as a more sustainable livestock production system, can only be obtained if the breeders' income is guaranteed. The valorisation of traditional methods of production is one of the steps needed to achieve this objective, even if this requires time and money to support breeders, as well as an organized structure to market and promote the products.

There are few local breeds of poultry and rabbit still reared in Europe. In fact, after years of carelessness in favour of intensive production using selected crossbreed, it is only recently that the consumers have rediscovered the traditional produce, through the higher attention paid to quality and to old and traditional tastes and dishes.

In the North-West of Italy (Piemonte region) there are few local poultry and rabbit breeds still reared: the Piemontese Fawn Hen, the Saluzzo White Hen and the Carmagnola Grey Rabbit (Errante, 1998, 2002), that have been added to the official lists of the traditional products, first of the Piemonte region (BURP, 2001) and then of Italy (MiPAF, 2002), with another 3558 different agro-industrial products (of which only 52 are from poultry or rabbit). Additionally, for the safeguard of these breeds two Slow Food Presidia have been also created: one for poultry and one for rabbit (www.slowfoodfoundation.com).

Materials and methods

After years devoted to improving the numbers and the productive performances of such animals, a number of very interesting results have been obtained (Lazzaroni *et al.*, 2000, 2002, 2003 di Francesco *et al.*, 2002 Lazzaroni, 2002 Lazzaroni and Biagini, 2002a,b Falciola *et al.*, 2003 Lazzaroni and Luzi, 2004 Toscano Pagano and Lazzaroni, 2004 Lazzaroni and Moriano, 2005). Recently, for the three breeds a producers association has been established, to improve the marketing strategies: the "Consortium for Protection of Piemontese Fawn Hen, Saluzzo White Hen and Carmagnola Grey Rabbit".

The aims of the Consortium are: (i) the protection of biodiversity of the local traditional breeds (ii) the preservation of the purebred Carmagnola Grey Rabbits (iii) the valorisation and promotion of the local breeds productions (iv) the technical assistance for the partners (v) the application of the production rules for the involved breeds among the partners (vi) the labelling of the slaughtered animals and (vii) the inspection and checking of the production, transformation and commercialisation stages.

One of the first steps of the Consortium, established in 2005 and containing at the present around 30 poultry and rabbit breeders from the North-West of Italy (Piemonte region), was to carry out a market study, in order to know the number and the rate of production of the potential partners. This was followed by the registration of a brand name, to make it easier to distinguish the products on the market, and the drafting of production rules (both for poultry and rabbit breeders), to guarantee the consumer about the production methods. There were then further studies on the possibility of improving the marketing strategies and increasing the number of saleable products.

For the development of the market of local breeds reared by traditional methods it is important to be able to sell not only the fresh meat, or the entire fresh carcass, but also portioned products stored under vacuum or modified atmosphere packaging, as well as in the form of ready-to-cook and ready-to-eat products, more suited to the present habits and life style of consumers.

Results and discussion

The potential structure of the Consortium, in terms of distribution of farmers according to the reared breed, so as the number of heads reared each year and the breed market percentage is reported in Table 1.

Table 1. Potential Consortium structure and market

Breeds	Breeders (n)	Estimated production (heads/year)	Breeds market (%)
Piemontese Fawn Hen	140	70,000	30
Saluzzo White Hen	50	5,000	70
Carmagnola Grey Rabbit	18	5,000	80

The numbers are encouraging for the future of the Consortium, testifying both the consumers interest for this kind of breeds (high number of reared animals) and the possibility of increasing the number of partners, along with an improvement of the Consortium activities.

The productive rules set up for the Consortiums partners concern several aspects (farm organisation, barn and cage characteristics, animals and feeds to be utilised, rearing and feeding techniques, heath therapy, etc.), but are particularly characterised by the slaughtering requirements in term of age of animals, their live weight, and kind of products obtainable (Table 2), so as by the labelling rules.

Table 2. Consortium slaughtering requirement and classification

Breeds	Animal age (d)	Live weight (kg)	Carcass weight (kg)	Carcass class
Piemontese Fawn Hen	120	1.5-2	1.350	1
		2-2.5	1.350-1.600	2
		2.5	1.600	3
Saluzzo White Hen	120	1.5-2	1.350	1
		2-2.5	1.350-1.600	2
		2.5	1.600	3
Carmagnola Grey Rabbit	90	3	1.800	1

For the development of the market several products have been tested. Attention has been focussed particularly on the ready-to-eat products, to examine the possibility of better utilising the produced meat, without then being linked to the productive cycles, and to extend the products shelf-life.

The first chosen ready-to-eat products to be tested are linked to the traditional utilisation of such meats and are: cooked meat in oil (breast and leg) obtained from the Saluzzo White Hen or from the Carmagnola Grey Rabbit, meat sauce (meat and tomato) and p té (meat and liver) obtained from the Carmagnola Grey Rabbit.

For each product different traditional recipes have been tested by expert gastronomists to choose those more suitable to the taste of today s consumers, and now the products are present on the market (Table 3).

Table 3. Consortium products ingredients and suggested utilisation

Breeds	Products	Ingredients	Use
Saluzzo White Hen	Meat in oil	Saluzzo White Hen meat, olive oil, raspberry vinegar, salt	Hors d oeuvre, served alone or with salad and balsamic vinegar
Carmagnola Grey Rabbit	Meat in oil	Carmagnola Grey Rabbit meat (73%), olive oil, butter, onion, white wine vinegar, black pepper, garlic, natural aroma, salt	Hors d oeuvre, to be served with corn salad and balsamic vinegar
	Meat sauce	Tomato, Carmagnola Grey Rabbit meat (45%), extra vergine olive oil, onion, parsley, garlic, salt	Dressing for pasta, preferably fresh tagliatelle
	P té	Carmagnola Grey Rabbit meat (65%) and liver (22%), onion, bacon, extra vergine olive oil, white wine vinegar, salt, carrots, celery	On warm toasts or as vol-au-vent stuff

At present, in one year of activity, the Consortium has been able to produce and commercialise a good amount of these ready-to-eat products (Table 4).

Table 4. Consortium ready-to-eat production

Products	Pots (n)	Pot weight (g)
Saluzzo White Hen meat in oil	1500	300
Carmagnola Grey Rabbit meat in oil	300	280
Carmagnola Grey Rabbit meat sauce	3000	180
Carmagnola Grey Rabbit p té	4000	90

Some of them have been also tested by the consumers, showing a high acceptance rate in a sensory evaluation test using a hedonic rating on a 5 point scale (1 = dislike 5 = high appreciation). In fact 70% or more of the consumers answers are over the mean value: 68.9% for the Saluzzo White Hen meat in oil (n = 100), 81.1% for the Carmagnola Grey Rabbit meat sauce (n = 200), and 75.5% for the Carmagnola Grey Rabbit p té (n = 100) (Table 5).

Table 5. Consumers test answers for the Consortium ready-to-eat products

Products	Consumers answers (%)				
	1	2	3	4	5
Saluzzo White Hen meat in oil	1.6	4.8	23.8	31.7	38.1
Carmagnola Grey Rabbit meat sauce	2.4	3.6	13.0	36.7	44.4
Carmagnola Grey Rabbit p té	0.0	2.0	22.4	42.9	32.7

Conclusions

The results obtained are encouraging, and more products are going to be tested (cooked salami obtained from the Piemontese Fawn Hen, etc.). This allowed producers to better utilise their production and consequently increase their income. A web site has also been opened (www.asproavic.it), to increase the awareness of the Consortium and to publish its activities.

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Sardinian fermented sheep sausage: Microbial biodiversity resource for quality improvement

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SUMMARY – With the aim of improving the quality and the value of the Sardinian sheep sausage, the microflora involved in fermentation and ripening processes of this traditional foodstuff has been studied and characterized. During the fermentation phase a prominent presence of micrococci and staphylococci has been observed. The lactic acid bacteria (LAB) that were showing a slow growth rate during the first days were found as the prevalent microflora during the ripening. The presence of coliforms was observed especially during the early fermentation phase. Salmonella and Listeria spp. were never detected. Bacterial species identified were Lactobacillus plantarum, Staphylococcus xylosus, Staphylococcus lentus, Kocuria varians, Micrococcus spp. while yeast strains belonged to Trichosporon spp. Debaryomyces hansenii and Candida famata. The technological selection of autochthonous LAB and staphylococci, which is actually ongoing, will be crucial for the development of starter cultures suitable for the quality improvement of this typical Mediterranean foodstuff.

Keywords: Sheep sausage, traditional technology, autochthonous microflora, quality.

R SUM **–** "Saucisse fermentée de brebis de Sardaigne : Ressources en biodiversité microbienne pour l'amélioration de la qualité". Dans le but d'améliorer la qualité et la valeur de la saucisse de brebis, produite en Sardaigne, les microflores impliquées dans la fermentation ont été étudiées et caractérisées. Pendant la phase de la fermentation une présence considérable de microcoques et staphylocoques a été observée. Les résultats ont montré que les bactéries lactiques, en dépit d'un développement initial lent, se sont avérées être la microflore prédominante pendant la maturation. La présence de coliformes a été observée pendant la phase de fermentation. Les espèces bactériennes identifiées étaient Lactobacillus plantarum, Staphylococcus xylosus, Staphylococcus lentus, Kocuria varians et Micrococcus spp. parmi les levures les espèces Debaryomyces hansenii, Candida famata et Trichosporon spp. La sélection technologique de LAB et staphylocoques autochtones sera cruciale pour le développement des cultures starter pour l'amélioration de la qualité de ce produit alimentaire méditerranéen typique.

Mo s s : Saucisse de brebis, technologie traditionnelle, microflore autochtone, qualité.

Introduction

Different projects have been recently undertaken in Sardinia with the aim to improve the global value of sheep meat-based food products. Most of the times this was achieved through the recovery of ancient and/or traditional manufacture procedures. This was the case of the ripened sheep sausages as well as the "prosciutto" (ham) or "coppa" (air-dried whole shoulder) made from sheep meat. The production of these kind of traditional foodstuffs constitutes a valuable alternative to jobs connected with meat-based manufacture and a good opportunity to improve their value possibly providing higher remunerations.

Among the stuffed meat-based fermented products manufactured in Sardinia (Italy) ripened sheep sausage (actually a kind of salami) plays a special role because of its typical features. The production technology, that is currently very similar to the traditional one, is comparable to the manufacturing process employed for pork sausages. Few differences can be identified with respect to this latter and they are mainly related to the extra-care for sheep meat selection and preparation such as the elimination of the connective tissues as well as the fat, both responsible for unpleasant taste. The technological procedures employed for sheep sausage production are as follows.

Meat preparation: different cuts of sheep's meat from healthy animals are commonly used, in particular shoulder, sirloin and legs.

Preparation of the mix: traditionally, sheep meat is minced in small pieces (approx. 1 cm diameter) and then mixed with pork fat (cut in small pieces) that soften the typical taste of ovine meat. Variable amounts of salt (2.8-3%) and spices (mostly pepper and garlic) are added. In the traditional manufacturing process, that was made without any starter culture, the fermentation process is carried out by natural microflora associated to the ingredients. In some cases vinegar or white wine, undergoing malolactic fermentation, are used to obtain a superior quality product. The mix is left to set down overnight in a fresh and dry environment. Only rarely sugar, a microbial starter and/or other addictives are added.

Stuffing sausage and ripening: after stuffing the sausages into the casings, these are smoked for up to 10-15 days and then ripened for up to 20 or 30 days.

The Sardinian sheep sausage is currently a niche foodstuff product that, even if manufactured following a traditional technology, is often inadequate and too much diversified in order to obtain a qualitatively stable product with constant features. Moreover, and most importantly, the final quality of the sheep sausage is strictly dependent on the knowledge of all those factors influencing the microbial presence and contamination in the production chain and hence the safety of the product. Ovine meat, particularly deep tissues, presents a less extent of microbial contamination with respect to other meats. Microbiological studies on sheep meat revealed the presence, almost exclusive, of staphylococci while clostridia, *Escherichia coli*, *Pseudomonas*, *Enterobacter* and *Yersinia* were not found (Newton *et al*., 1978). More recently the presence of *Lactobacillus plantarum*, *Staphylococcus xylosus* and a significant number of yeasts and micrococci was also assessed (Mangia *et al.,* 2002). Research investigations on meat-based Sardinian foodstuffs such as sheep sausages are globally few and do not offer a global picture of the microbial and chemicophysical status of these products (Mazzette *et al.*, 1996).

Deepening our knowledge on the microbial species responsible for fermentative and ripening processes in traditional Sardinian sausages can be certainly a suitable way to improve the intrinsic value and the quality of these foodstuffs.

The aim of this work was to isolate, characterize and select from a physiological, biochemical and technological point of view the natural microflora present in sheep sausages manufactured with the traditional technology. This will finally offer the possibility to make up an autochthonous and specific starter culture for this typical Mediterranean production.

Materials and methods

Sampling procedures

Mince sheep meat and sausage samples (made from this meat) where colleted at different ripening times and particularly at 1, 2, 3, 5, 7, 9, 13, 18 and 23 days of ripening. Samples were collected from a factory that ordinary employs a traditional manufacturing technology. Meat samples were collected before and after spice and wine addition. Before starting microbiological analysis, sheep sausages were cleaned with a brush to avoid microbial contamination from the outside.

pH measurements

Potentiometric measurements of the pH were made using a pin electrode of a pH-meter (KNICK Portamess 911) inserted directly into the sample.

Microbiological analysis

Aliquots of 25 g form each sample were transferred into a sterile stomacher bag and 225 ml of peptone water (Oxoid) were added and mixed for 1.5 min in a Stomacher Lab-Blender 80 (PBI).

Further, ten-fold dilutions were made and aliquots used to inoculate the following solid media in

order to detect and quantify different microbial groups: aerobic mesophilic bacteria were determined on PCA (Oxoid) incubated at 30°C for 48-72 h lactic acid bacteria (LAB) were counted on a double layer MRS agar (Oxoid) after incubation for 48 h at 30°C staphylococci and micrococci were quantified on Mannitol Salt Agar (Oxoid) incubated for 48 h at 30°C BGBB (Oxoid) was used for the enumeration of total and faecal coliforms. Numbers were determined after incubation on a double layer BGBB at 37 and 44°C for 24-48 h yeasts and moulds were enumerated on Malt Extract Agar (Oxoid) incubated at 25°C for 48-72 h the presence of *Salmonella* spp. was tested using a Salmonella Rapid Test (Oxoid) while the presence of *Listeria* spp. was verified after enrichment in Fraser Broth Base (Oxoid) plus supplement Fraser SR 156 (Oxoid).

Identification of microbial isolates

From each counting media approximately 10 colonies were randomly selected for further identification.

The morphology, Gram-stain and catalase activity of these isolates were preliminary tested. Gram positive and catalase-positive cocci were purified on MSA and maintained on slant tubes with the same medium at 4°C. Purified strains were classified according to Kloos *et al.* (1991). They were further subjected to the following tests to differentiate micrococci and staphylococci: sensitivity to furazolidone (Von Rheinbaben and Hadlok 1981) and lysostaphin (Schleifer and Kloos 1975). Staphylococci were assayed for coagulase activity, and finally identified using API STAPH and ID 32 STAPH Systems (bioMerie ux, Marcy l Etoile, France).

LAB identification was carried out according to Bergey's Manual of Systematic Bacteriology (Sneath *et al.,* 1986), Bridge and Sneath (1983) and carbohydrate fermentation patterns determined using API 50 CH and API 20 Strep test galleries (API System bioMerieux, Marcy l'Etoile, France).

Yeast identification was carried out after Kurtzman and Fell (2000).

Results and discussion

In this paper the composition and the evolution of micro-organisms associated to the Sardinian traditional fermented sheep sausages were investigated at different ripening times. Table 1 is showing the evolution of the main microbial groups investigated. Total mesophilic count (TMC) revealed higher values (approx. 3E+10 cfu/g) at the end of ripening with respect of those reported by other authors (Mazzette *et al*., 1996). However these numbers can be considered as common for stuffed fermented products. Micrococci and staphylococci, already present in the meat (MM), showed a very rapid increase reaching final values of 1.66E+09 cfu/g 23 days after ripening. The significant number of these micro-organisms is related to the intrinsic features meat as well as to the artisanal technology employed, that involves an extensive manual treatment of the product. Although LAB showed a slow growth rate during the first period of ripening, after the 5^{th} day values higher than one billion of cells per gram were recorded. Our data are globally supporting other findings stating that LAB are the dominating microflora during the ripening.

Heterofermentors LAB were found absent in all the samples analysed.

The microbiological survey showed a significant initial contamination of sheep sausage with faecal coliforms reaching important values most likely due to optimal pH and a_w . This can be considered an index of the poor hygienic conditions employed during the preparation steps as well as during the whole manufacturing process.

Yeasts were always found present and their number slowly increased during the ripening period while the number of moulds remained stable. Despite suboptimal hygienic conditions *Salmonella* and *Listeria* species were never detected.

Globally 161 microbial strains belonging to the species *Lactobacillus plantarum*, *Staphylococcus xylosus, Staphylococcus lentus*, *ocuria varians*, *Micrococcus* spp., *richosporon* spp., *Debaryomyces hansenii* and *Candida famata* were isolated. Table 2 reports the general view of the species isolated and their evolution during the ripening.

Table 1. Evolution of autochthonous microflora in sheep sausage at different ripening times

Samples	Microbial groups								pH
	TMC (cfu/g)	Lactic acid bacteria (cfu/g)	Micrococci, staphylococci (cfu/g)	Faecal coliforms (mpn/g)	Yeasts (cfu/g)	Moulds (cfu/g)	*Salmonella*	*Listeria*	
MM	4.83E+02	3.67E+02	6.73E+03	23	1.43E+03	4.00E+01	absent	absent	5.69
MMS	7.57E+02	3.53E+02	1.05E+04	43	1.73E+03	7.33E+01	absent	absent	5.66
S 1d	8.26E+03	2.93E+02	7.87E+03	150	1.28E+03	8.00E+01	absent	absent	5.63
S 2d	4.43E+04	2.33E+02	6.13E+03	150	1.57E+03	6.67E+01	absent	absent	5.68
S 3d	3.80E+04	1.80E+02	6.33E+03	43	1.35E+03	4.67E+01	absent	absent	5.66
S 5d	8.68E+06	4.85E+06	1.34E+05	43	2.08E+03	1.07E+02	absent	absent	5.69
S 7d	2.69E+09	1.40E+09	3.45E+05	93	1.12E+04	5.33E+01	absent	absent	5.76
S 9d	7.27E+08	1.30E+09	6.69E+06	240	2.02E+05	4.67E+01	absent	absent	5.69
S 13d	1.58E+10	5.52E+09	5.12E+08	93	5.41E+05	1.33E+01	absent	absent	5.61
S 18d	3.52E+10	1.47E+10	6.10E+08	43	8.13E+05	1.33E+02	absent	absent	5.59
S 23d	3.10E+10	2.23E+10	1.66E+09	150	1.45E+06	1.47E+02	absent	absent	5.73

MM=minced meat MMS= minced meat with spices S=sausage d= days of ripening TMC=total mesophilic count.

Table 2. Number of species isolated from sheep meat and sausage at different ripening times

Isolated species	MM	MMS	Ripening times									Frequency
			S 1d	S 2d	S 3d	S 5d	S 7d	S 9d	S 13d	S 18d	S 23d	
Lactobacillus plantarum	1	2	1	3	1	1	8	11	12	5	1	29.00%
Lactobacillus spp.	0	2	4	0	1	3	3	2	1	3	1	12.42%
Staphylococcus xylosus	0	0	1	1	1	2	2	4	3	3	3	12.42%
Staphylococcus lentus	0	1	0	0	0	0	0	0	0	0	0	0.62%
Staphylococcus spp.	1	2	1	0	2	1	2	3	3	2	1	11.18%
Micrococcus spp.	0	1	1	1	2	1	2	0	0	0	0	4.97%
ocuria varians	1	0	0	0	0	0	0	0	0	0	0	0.62%
Debaryomyces hansenii	1	1	0	1	2	3	3	4	4	7	5	19.25%
Candida famata	2	3	2	0	1	2	0	0	0	0	0	6.21%
richosporon spp.	1	2	1	1	1	0	0	0	0	0	0	3.73%

MM=minced meat MMS= minced meat with spices S=sausage d= days of ripening.

The identified LAB were only represented by species belonging to a single genus in contrast to what found for Sardinian pork sausages (Greco *et al*., 2005). The number of *L. plantarum* increased until the 13th day then declined in the following period. *L. plantarum* is the most represented LAB in all the stuffed foodstuffs fermented by natural microflora (Zambonelli *et al*., 1992). Optimal growth for *L. plantarum* occurs at temperature higher than 30°C hence the fermentation rate is substantially influenced by this parameter. To this regard temperature of about 25-30°C were recorded during the first phases of drying and smoking of the sheep sausage, most likely maximizing the *L. plantarum* presence.

Strains belonging to the *Micrococcus* genus have been recovered during the first days of ripening (4.97% frequency) being these micro-organisms obligate aerobes, after this period their number decreased most likely because of a gaseous phase progressively lacking oxygen. During this phase micrococci are replaced by staphylococci that predominated during the last part of the ripening. The most abundant specie was *Staphylococcus xylosus* with the 12.42% of recovery frequency this is confirming what reported by other studies investigating the microbiological features of Italian stuffed products (Zambonelli *et al*., 1992 Aymerich *et al*., 2003). *Staphylococcus lentus* and *ocuria varians* have been recovered in low number (0.62%). The slow growth rate showed in the beginning by LAB and staphylococci put in evidence the need for adding glucose or lactose in order to support fermentative processes and inhibit undesirable organisms such as *faecal coliforms*. *Debaryomyces hansenii* has been the most recovered species (19.25%, possibly because it is more halotolerant than

other yeasts) confirming previous findings (Dalton *et al.,* 1984). Because of its invariable presence this species is commonly considered as the typical yeast of stuffed products (Entel, 1961). *richosporon* spp. that was found highly present in the slaughters has been recovered with a 3.73% of frequency during the first phase of ripening.

This study allowed to identify the micro-organisms characterizing fermentative and ripening processes of the Sardinian sheep sausage. This can be considered as a suitable baseline for the choose of the microbial species that could be employed to make up an autochthonous starter culture for the manufacturing process. By the way it is essential to deepen our knowledge on strain metabolism, on their ability to carry out fermentative and ripening processes as well as their suitability for quality improvement and the maintenance of the typical features of sheep sausage.

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Rabbit meat production as affected by a delayed-weaning technique

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SUMMARY – Nowadays there is an increasing interest towards breeding systems, also for rabbit meat production, more mindful of animal welfare through an attenuation of the productive cycle intensity. These particular rearing techniques provide a delaying of the weaning age to reduce stress in young rabbits. The present research investigated the influence of weaning age on 192 crossbred rabbits (New Zealand White x Californian) divided in two experimental groups weaned at 28 (W28) and 63d (W63) respectively. From the statistical analysis significant differences emerged by comparing resulting data from W28 vs W63 rabbits, concerning productive parameters, commercial traits and composition of carcasses, meat chemical-nutritional characteristics.

Keywords: Weaning age, productive performance, meat, rabbit.

RESUME – "Production de viande de lapin selon une technique se sevrage retardé". L'intérêt pour des systèmes d'élevage de lapin à viande respectueux du bien-être des animaux est grandissant. La conduite plus souple des cycles de production et un sevrage tardif des lapereaux font partie des techniques testées. Le présent travail concerne l'influence de l'âge du sevrage sur les performances zootechniques (croissance, composition des carcasses) et technologiques de la viande. En situation d'élevage contrôlé, 192 lapins croisés (Néo-Zélandais Blanc x Californien), sont considérés et divisés en deux groupes sevrés respectivement à 28 (W28) et 63 (W63) jours. Les résultats montrent des différences significatives entre les deux lots sur les paramètres de production, la composition et la qualité commerciale des carcasses, les caractéristiques chimiques-nutritionnelles de la viande.

Mots-clés : Age au sevrage, performances productives, viande, lapin.

Introduction

The weaning age has been significantly anticipated in virtue of the deep variations occurred within the rabbit rearing during the last two decades. In particular, its transformation from rural to exquisitely industrial has implied the intensification of the rearing techniques with a productive answer typically quantitative. The weaning age has been anticipated also to improve the corporal condition of reproductive rabbit does by shortening the lactation period. But inevitably, the excessive exploitation of the rabbit species has seen as a consequence the spreading of several conditioned pathologies (Marongiu et al., 2004).

The increased interest in "ethical quality" of meat (Dal Bosco et al., 2002) has led to the implementation, also for rabbit production, of less intensive breeding systems, that are more mindful of animal welfare. These particular rearing techniques provide a delaying of the weaning age to reduce young rabbits stress. The present research aimed to investigate the rabbit meat production as affected by a delayed-weaning technique by comparing two experimental groups of rabbits weaned at 28 and at 63 days of age respectively. The survey was carried out in a Sardinian farm where rabbits are usually weaned at about 60 days of age. Surely this managerial choice could be considered rather questionable but from a scientific point of view could also represent a unique opportunity to examine in vivo productive performance, carcasses commercial traits and composition, meat chemical-nutritional characteristics of rabbits submitted to such a late weaning.

Materials and methods

Animals

The trial was carried out on a total of 192 crossbred rabbits (New Zealand White x Californian) belonging to 24 litters. At birth litters were equalized at eight kits all individually weighted. Rabbit does were given *ad libitum* a commercial pelleted feed and suckled by their kits once daily in the morning. Individually conducted live weights of litters were weekly recorded. At 28 days of age half the litters were weaned, that is to say 96 subjects (W28) were separated from their mothers successively to the weekly live weight recording. After weaning, rabbits were fed *ad libitum* a commercial pelleted feed (16.5% protein, 2520 kcal/kg ME) and given free access to water. They were housed two to a cage kept in a room with artificial ventilation and a 16h light-8h dark schedule. The following parameters were weekly and individually recorded: live weight daily solid feed intake daily weight gain. A late weaning was performed at 63 days of age on the remaining 96 experimental rabbits (W63). After weaning they were reared with the same modalities and submitted to the same weekly controls with regard to the rabbits previously weaned at 28 days. Rabbits were all slaughtered at 83 days of age. Care and use of animals were performed in accordance with the guidelines established by the European Community (no. 86/609/CEE) and approved by the Italian Ministry of Health (L. n. 116/92) regarding animal treatment and commercial slaughtering.

Carcass measurements

Immediately prior slaughter all experimental rabbits live weights (LW) were recorded. The rabbits were rendered unconscious by electric stunning and killed by exsanguinations. Blood was removed and the net live weight (NLW) was individually calculated subtracting the blood weight from the LW values. The carcasses were prepared by removing skin, distal legs, genital organs, urinary bladder and gastrointestinal tract (Blasco *et al.,* 1993). Hot carcasses were weighted (HCW), dressing out percentage (DP) was calculated and pH was measured 30 minutes after slaughter (pH_{30min}). After refrigeration at 2°C for 24 h cold carcasses weights (CCW) were recorded and ultimate pH (pH_u) measured. Head, lungs, thymus gland, trachea, heart, liver and kidneys were removed and carcasses were classified, by visual examination, using a scale of 5 $\pm$ scores for the conformation, fatness and colour of carcasses (ASPA, 1991 with our adaptation). The main linear measurements were also effectuated on cold carcasses hanging from a 18 cm wide hook peculiar to maintain carcass hind legs 18 cm wide: body length, loin width, chest width, carcass length, chest depth and leg length. Carcasses were then dissected to measure fat content and muscle to bone ratio (M/B) (Parigi Bini *et al.,*1992a).

Meat analyses

From 18 carcasses of W28 and 18 of W63 group the left hind legs were isolated and the meat was milled for moisture and ash analysis (AOAC, 2000). Fat was analysed according to Folch *et al.* (1957) and the protein content was calculated by difference. Hydroxyproline (ASPA, 1996) allowed to determine the collagen content (Sorensen, 1981). Meat samples were frozen at -18°C prior mineral analysis. The mineralization in Microware ETON D (Millistone) was performed using an Atomic Absorbance Spectrometer (SpectrAA220, Varian). Fatty acid composition was determined after extraction (Folch *et al.,* 1957) and metilation (Christies, 1989), by using a GC Thermo uest series 8000Top (column Omega-Wax 320cm 0.25μm Supelco). The n6/n3 ratio as well as the atherogenic (IA) and thrombogenic (IT) indexes were calculated from the fatty acid composition, as suggested by Ulbricht and Southgate (1991).

Statistical analyses

Comparison between means was effectuated by the Student-Newman-Keuls *t*-test. Meat data were analysed by ANOVA (SAS, 2000) using the model: $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$, where Y is the single observation, μ the general mean, α the age at weaning effect (i = 28 or 63d), ε the error.

Results and discussion

The productive performance from birth to slaughter of experimental rabbits are reported in Table 1. Mean values of live weight at 83 days and daily weight gain from 64 to 83 days of the two experimental groups W28 *vs* W63 (2167 *vs* 1837 g 28.4 *vs* 18.0 g) showed highly significant differences (P<0.01). W28 rabbits also performed a greater daily feed intake (113.0 *vs* 88.9 P<0.05) and a better feed conversion index (3.979 *vs* 4.439 P<0.05).

Table 1. Main productive traits of rabbits. Means s.d. and statistical significance

	W28	W63	Significance
Live weight (g)			
0 d	58 11	57 9	ns
28 d	493 25	521 42	ns
63 d	1600 28	1477 125	ns
83 d	2167 21	1837 121	**
Daily weight gain (g/d)			
0-28 d	15.6 0.6	16.6 0.9	ns
29-63 d	31.6 0.	27.3 2.5	ns
64-83 d	28.4 1.3	18.0 6.4	**
Daily feed intake (g/d)			
29-63 d	78.1 13.5	--	
64-83 d	113.0 36.5	88.9 42.8	*
Feed conversion index			
29-63 d	2.472 0.057	--	
64-83 d	3.979 0.044	4.439 0.149	*

ns = not significant * = P<0.05 ** = P<0.01.

Main commercial characteristics of carcasses at slaughter are shown in Table 2. Data about W28 carcasses appear to be in agreement with other researches carried out on rabbits slaughtered at the same age (Parigi Bini *et al.,* 1992a Bernardini *et al.,* 1994). The dressing out percentage of carcasses, which is considered a very important economic variable in the rabbit market, was significantly higher in W28 compared to W63 group (59.71 *vs* 51.71 % P<0.05). Moreover, except for pH_{30min}, all the considered traits showed statistically significant differences between the two experimental groups.

Data concerning the carcass conformation, using a 5 ± scores evaluation scale, put in evidence a better result of W28 in comparison to W63 carcasses. W28 group was evaluated quite good also from a commercial point of view, considering that 82.3 % of the carcasses were scored 2±.

In Table 3 are presented the linear measurements of rabbit carcasses. It can be noticed that loin width, chest width and chest depth measurements of W28 carcasses were significantly higher compared to W63 experimental group (12.4 *vs* 11.3 cm, P<0.01 9.0 *vs* 8.2 cm, P<0.01 6.5 *vs* 6.1 cm, P<0.05). The linear measurements values obtained in the present survey appear in disagreement with previous researches (Battaglini *et al.*, 1993 Lukefahr and Ozimba, 1991). Nevertheless the mentioned studies report some linear measurement effectuated *in vivo* and at different ages. Therefore the main linear measurements of carcasses could represent an additional tool for supporting the evaluation of rabbit meat production.

Table 4 shows the average coefficients of correlation between the linear measurements and the dressing out percentage of carcasses. These correlations, expect for the loin width and the chest width, resulted closer between the linear measurements and dressing out percentage of W28 carcasses if compared to the correlations of W63 group. In particular, the closest coefficient of correlation (r=0.844) resulted between the chest depth and the dressing out percentage of W28 carcasses.

Table 2. Commercial traits of carcasses. Means ± s.d. and statistical significance

	W28	W63	Significance
Live weight (LW) (g)	2167±157	1837±100	**
Net live weight (NLW) (g)	2102±110	1787±91	*
Hot carcass weight (HCW) (g)	1294±98	950±82	**
Cold carcass weight (CCW) (g)	1179±96	829±73	*
pH_{30min}	6.45±0.22	6.50±0.24	ns
pH_u	6.08±0.16	6.24±0.17	**
Dressing out percentage (DP) (%)	59.71±8.05	51.71±6.12	*
Incidence (%) on NLW:			
Carcass	61.56±8.08	53.16±6.44	*
Head	5.19±0.14	6.94±0.18	**
Skin	13.13±2.01	14.87±2.08	**
Distal legs with skin	6.85±0.32	7.93±0.52	**
Lungs, thymus and trachea + heart	2.95±0.02	3.96±0.03	*
Empty gastrointestinal tract	5.42±0.15	6.88±0.17	**
Gastrointestinal fat	0.90±0.01	0.75±0.01	**
Blood	2.90±0.02	3.31±0.03	*
Genitals + losses	1.10±0.01	2.20±0.02	**

ns = not significant; * = P<0.05; ** = P<0.01

Table 3. Linear measurements of carcasses (cm). Means ± s.d. and statistical significance

	W28	W 63	Significance
Body length	32.8±1.0	32.3±1.0	ns
Loin width	12.4±0.7	11.3±0.8	**
Chest width	9.0±0.4	8.2±0.	**
Carcass length	26.9±1.0	26.8±1.0	ns
Chest depth	6.5±0.6	6.1±0.	*
Leg length	16.5±0.8	16.2±0.7	ns

ns = not significant; * = P<0.05; ** = P<0.01

Table 4. Mean coefficients of correlation (r) between the linear measurements and the dressing out percentage of carcasses

Linear measurements	Dressing out percentage		Significance
	W28	W63	
Body length	0.659	0.070	**
Loin width	-0.063	0.242	*
Chest width	0.347	0.512	*
Carcass length	0.633	0.224	*
Chest depth	0.844	0.176	**
Leg length	0.392	0.316	ns

ns = not significant; * = P<0.05; ** = P<0.01

Table 5 synthesizes the average composition and the meat to bone ratio of carcasses. Resulting data about W28 group appear in agreement with other studies considering similar carcass traits (Pla et al., 1998 Parigi-Bini et al., 1992a). In W28 carcasses the fat percentage was significantly higher while the bone percentage significantly lower when compared to W63 carcasses (4.3 vs 2.4 %, P<0.01 11.3 vs 13.4, P<0.01). Consequently, also the meat to bone ratio was significantly higher in W28 group (7.54 vs 6.28, P<0.01).

Table 5. Average composition and meat to bone ratio (M/B) of carcasses

	n	Fat %	Muscle %	Bone %	M/B
W63	96	2.4^{B}	84.2	13.4^{A}	6.28^{B}
W28	96	4.3^{A}	84.4	11.3^{B}	7.54^{A}

A, B: P<0.01

According to that, the meat chemical composition (Table 6) showed significant differences for fat, higher in W28 rabbits. At this regard, it seems appropriate specify that it was not possible to measure the solid feed intake of suckling rabbits (allowed to consume the same diets of the mothers). On the other hand, the feed intake of W28 group was significantly higher in the period 64 - 83d (113 vs 89 g/d P<0.05). Our data are anyhow in agreement with those reported by other authors (Parigi-Bini et al., 1992b Nizza and Moniello, 2000). Although collagen content was higher in W28 rabbits, there were not significant differences between groups.

Table 6. Chemical composition of meat

	n	Moisture %	Ash %	Protein %	Total Fat %	Collagen mg/100g
W63	18	71.79 1.65	1.47 0.11	24.11 2.91	2.63^{b} 0.69	47.66 5.06
W28	18	72.32 2.15	1.44 0.18	23.22 3.42	3.02^{a} 0.73	49.10 6.52

a, b: P<0.05

With regard to the macro and micro mineral meat composition (Table 7), in agreement with the values reported by Parigi-Bini et al. (1992b), the most important differences consisted in iron (1.25 vs 0.93 mg/100g, P<0.01), copper (0.17 vs 0.14 mg/100g, P<0.05) and manganese (0.03 vs 0.02 mg/100g, P<0.05) contents, significantly higher in W28 rabbits.

Table 7. Mineral composition (mg/100g) of meat

	Ca	P	Na	Mg	Fe	K	Se	Cu	Mn	Zn
W63	10.91	212.78	60.22	31.35	0.93^{B}	440.81	24.54	0.14^{b}	0.02^{b}	1.58
n=18	(1.90)	(25.28)	(5.86)	(2.73)	(0.07)	(29.03)	(3.74)	(0.04)	(0.004)	(0.23)
W28	10.33	210.42	62.42	30.78	1.25^{A}	432.90	24.27	0.17^{a}	0.03^{a}	1.59
n=18	(1.38)	(30.87)	(6.24)	(2.91)	(0.10)	(27.02)	(3.12)	(0.03)	(0.006)	(0.25)

( ) standard deviation A, B: P<0.01 a, b: P<0.05

Table 8 shows the meat fatty acid (FA) composition as well as the atherogenic and thrombogenic indexes by weaning age. The W63 rabbits meat, looking at FA expressed as percentage of total determined FA, showed significantly higher saturated FA (SFA, 43.0 vs 40.3%, P<0.05) and lower monounsaturated FA contents (20.3 vs 23.7%, P<0.01). This could be presumably due to the longer lasting milk intake in W63 rabbits. As a matter of fact does milk, in terms of FA composition, consists for about 80% in SFA (Castellini et al., 2004). There were not differences in total polyunsaturated FA content while higher C18:2 and C18:3 (P<0.05) levels were found in W28 group. This could be

explained by the earlier and more conspicuous vegetable feed intake performed by the W28 rabbits, considering that the origin of these fatty acids are not endogenous but it is the result of diet: cereals particularly provides linoleic acid and lucerne linolenic acid. Our fatty acid profile data appear in accordance with those recently reported by Ram rez et al. (2005).

Table 8. Fatty acid composition (means s.d.) of meat

	W63 (n=18)	W28 (n=18)	W63 (n=18)	W28 (n=18)
	mg/100g of meat		% of total FA	
C14:0	47.01^{B} 4.44	54.72^{A} 4.03	2.58 0.29	2.77 0.32
C16:0	584.9^{B} 40.2	658.6^{A} 59.44	32.15 4.81	33.34 4.17
C18:0	137.9^{b} 11.33	151.6^{a} 17.37	7.57 2.55	7.68 1.58
C20:0	7.14^{a} 1.63	6.43^{b} 1.52	0.39 0.09	0.33 0.08
C22:0	5.78 0.94	5.15 1.34	0.32 0.12	0.26 0.10
SFA†	782.8^{B} 71.33	876.6^{A} 70.14	43.01^{a} 3.06	40.30^{b} 2.51
C18:1	359.7^{B} 32.55	502.8^{A} 41.70	19.74^{B} 1.36	25.44^{A} 2.91
C20:1	7.87 0.89	7.99 0.78	0.43 0.02	0.40 0.05
C22:1	3.08^{B} 0.65	4.37^{A} 0.63	0.17^{B} 0.02	0.22^{A} 0.03
MUFA†	370.6^{B} 32.59	515.1^{A} 42.45	20.34^{B} 1.36	23.69^{A} 1.11
C18:2	603.7^{B} 47.46	708.9^{A} 48.93	33.17 4.95	35.91 4.09
C18:3	63.16^{B} 5.24	73.36^{A} 3.57	3.47^{b} 0.21	3.72^{a} 0.40
PUFA†	666.8^{B} 58.2	782.3^{A} 52.38	36.64 2.03	36.01 3.24
n6/n3	9.56 1.22	9.66 1.93	-	-
IA	0.75^{A} 0.03	0.68^{B} 0.02	-	-
IT	1.14^{A} 0.04	1.04^{B} 0.06	-	-
Total FA, g/100g	1.82^{B} 0.15	2.17^{A} 0.14		

Between columns: A, B: P<0.01 a, b: P<0.05.
† SFA: Saturated fatty acids MUFA: Mono-unsaturated fatty acids PUFA: Poly-unsaturated fatty acids.

Finally, W63 group also displayed less favourable atherogenic and thrombogenic indexes. Thus, W63 meat seems also related to dietary-nutritional characteristics less corresponding to the modern requirements of consumers, mainly focused on the well known relationship of meat fat composition with human cardiovascular diseases.

However, it has to be considered that consumers definition of meat quality in developed countries not only includes nutritional properties such as appropriate proportions of bioactive compounds, proteins, lipids and their essential sub-constituents, healthiness such as fat and saturated fatty acids, but also views or perception about the conditions of animal production in relation to animal welfare (Dalle Zotte *et al.,* 2002). Moreover, meat sensory characteristics are crucial for the "traditional" consumer s choice: the appearance (colour and consistency of the raw meat), texture (tenderness and juiciness) and flavour (taste, smell and aroma). For this reason, it is our intention to get this investigation completed by performing a tasting test with regard to W28 and W63 meat products.

Conclusions

An extremely delayed weaning, beside being not convenient in terms of farm economy, affects the rabbit meat production by getting *in vivo* productive performance and carcass commercial traits worse. It seems also related to a meat product with dietary-nutritional characteristics less corresponding to the modern link meat quality-human health (fatty acid profile, atherogenic and thrombogenic indexes), if compared to the 28 days-weaning technique. On the other hand, a less intensive rearing system is surely more mindful of animal welfare, which is a concept nowadays of increased interest for several consumers.

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Atherogenic and thrombogenic index, acidic composition of lipid fraction of adipose subcutaneous tissue of female ancient autochthonous genetic type (AAGT) ***ser*** . Preliminary results[1]

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SUMMARY – The research was performed on samples of adipose subcutaneous and perirenal tissues of 5 Casertana sows, reared in multiple boxes at the ConSDABI experimental farm and slaughtered at ~160 kg of live weight. Casertana is an ancient autochthonous genetic type (AAGT), present nowadays mainly in Campania (Italy), where there is in progress an extensive programme recovery promoted by ConSDABI. The aim of this study was to characterize the lipid component of adipose tissue evaluated for "chemical-nutritional" and "chemical-extranutritional" quality. The results showed that, in all samples examined, the most abundant fatty acids were the C18:1 and C18:2; among the saturated fatty acids, the highest values being observed for C16:0. In the case of adipose subcutaneous sites the UFA/SFA ratio is about 2.30, while the perirenal fat shows a UFA/SFA ratio of about 1.60. These results highlighted that the subcutaneous adipose tissue of Casertana AAGT is a source of fatty acids with functional features to human health and therefore can be conveniently inserted in a correct diet.

Key words: Casertana pig, ancient autochthonous genetic type, atherogenic index, thrombogenic index.

R SUM **–** "Index athérogénique et thrombogénique, composition acidique de la fraction lipidique du tissu adipeux sous-cutané de femelles de l'ancien type génétique autochtone (TGAA) Casertana. Résultats préliminaires". L'étude a été conduite sur des échantillons de tissu adipeux (sous-cutané et périrénal) de porcs femelles TGAA Casertana, élevées dans des box multiples près de la structure expérimentale du ConSDABI et abattues à un poids moyen proche de 160 kg. La Casertana est un type génétique autochtone ancien (TGAA) présent, principalement en Campanie (Italie) où est menée une vaste récupération promue par le ConSDABI. L'objectif de ce travail est de caractériser la composante lipidique du tissu adipeux examiné pour évaluer la qualité "chimique-nutritionnelle" et "chimique-extranutritionnelle". Les résultats ont mis en évidence : les acides gras les plus abondants sont C18:1 ; C18:2 et C16:0. Dans le tissu adipeux sous-cutané le rapport UFA/SFA est proche de 2,30 ; dans le tissu périrénal, il est proche de 1,60. Le tissu adipeux sous-cutané du TGAA Casertana, donc, peut être convenablement intégré dans un régime alimentaire correct.

Mo s s : Casertana, type génétique autochtone ancien, index athérogénique, index thrombogénique.

Introduction

The increasingly trend of human nutritional studies towards the reduction of fats in human diet has determined, in recent years, a considerable decrease of the consumption of foods of animal origin, above all pork meat.

The pig is a monogastric animal that, like ruminants, normally eats vegetable feeds. However,

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unlike ruminants, it cannot biohydrogenate vegetable fats this causes a higher presence of unsaturated fatty acid in the intramuscular and storage fat in comparison with the other animals for slaughtering. Moreover, unlike vegetable fat and fat from other mammalians, the triglycerides of pork fat have unsaturated fatty acid in sn position (stereochemical numbering) 1 and 3 and the saturated fatty acid in position 2 (di Luccia et al., 2003). These traits make meat of this species very interesting, since the unsaturated acids are immediately available indeed, the human digestive lipase hydrolyzes the triglycerides firstly in position sn1 and sn3 and, secondly, by means of isomerase, which shifts the fatty acid from position 2 to position 1 or 3, hydrolyzing the triglyceride fully. A major availability of saturated fatty acids can affect positively human feeding, implying a decrease of saturated fatty acid (SFA), improving the UFA (unsaturated fatty acids)/SFA ratio, to which an increasingly important role is ascribed in prevention and/or reduction of cancer, atherosclerosis and obesity (Nielsen et al., 1995 Williams, 2000).

The typifying of lipidome (set of lipids and their interactions in an organism), is important in order to better understand the qualitative production potentiality of a genetic resource. In the last years the evolution of the studies on qualitative traits of pork meat i.e. the meat from pig ancient autochthonous genetic type (AAGT) Casertana , is allowing to highlight some health aspects of the same, contributing to its reassessment, above all in relation to the high nutritional power of some UFA monounsaturated (MUFA) and polyunsaturated (PUFA) , present in adipose tissue.

The present study, through the determination of fatty acid composition in adipose and perirenal tissues, would contribute to the recovery and valorisation of Casertana AAGT, an ancient pig already described in I century BC by latin writer Lucio Giunio Moderato Columella, in his De re rustica.

Materials and methods

Sampling

The sampling concerned: (i) subcutaneous adipose tissue in thoracic site (SPT) at V-VII vertebra, distinctly for outer layer (SE) and inner layer (SI), and in lumbar site (SPL) at IV-VI vertebra, distinctly for SE and SI and (ii) perirenal adipose tissue. The samples were stored at -30°C up to the moment of their use for quali-quantitative analysis of acidic fraction performed according to the AOAC methods (1994).

Total lipid fraction extraction

50 g of adipose tissue was used for extracting total lipids by methanol-chloroform (2:1 vol/vol), according to the method of Folch et al. (1957).

Triglycerides determination

The lipid samples (30 mg) were dissolved into 1 ml of hexane 1 μl of this hexane solution was injected into a gas-chromatograph (Thermo uest S.p.A., Milan) equipped with a fused silica capillary column RT 65TG (30 m x 0.25 mm i.d. Restek Co., Bellafonte PA, USA). The temperature gradient used for the triglyceride separation was the following: from 340 to 360°C, 1°C/min the injector and revealer temperature was 380°C the moving phase flow (helium) was 1 ml/min with a split rate of 100:1. The quantitative values were calculated on chromatograms recorded by a Chrom Card for Window, previously identified and compared with a suitable external standard and with other chromatograms of known samples.

Fatty acid determination

Methylic esters of fatty acids were prepared adding 1.25 ml of heptane to a drop of fat placed in a test tube with screw plug and subsequently adding 0.25 ml of methanolic KOH to the same test tube the sample obtained was subjected to sonication for 6 min, at the end of which 1 μl of supernatant

was injected in a gas-chromatograph 5890 HP equipped with a fused silica capillary column fusa SP2380 30 m x 0.25 mm i.d. (Supelco, Inc., Bellefonte PA, USA) the used temperature gradient was the following: from 140 to 240°C, 1°C/min the carrier gas flow, helium, was 1.50 ml/min. The chromatograms were recorded and pick areas were calculated by Agilent Chemstation the identification was achieved through external standards (Larodan Lipids, ME 100). The obtained results were object of partial statistical elaboration.

Results and discussion

The composition of depot fat of anatomical parts under examination is reported in Tables 1, 2 and 3. The determination of acidic composition of lipid fraction showed that the percentage incidence of fatty acids and the UFA/SFA ratio vary in relation to the adipose tissue under examination (subcutaneous or perirenal), as well as, as regards to subcutaneous adipose tissue, in relation to the thoracic (SPT) and lumbar (SPL) site of sampling and to the layer investigated (SE or SI). The comment of results has validity within the observation field.

Table 1. Subcutaneous adipose tissue (backfat). Mean value, standard deviation and variation coefficient (cv %) of percentage incidence of some fatty acids†, distinctly for sampling site and layer

Fatty acid	Sampling site											
	Thoracic (SPT)						Lumbar (SPL)					
	††SI			†††SE			††SI			†††SE		
	$\bar{X} \pm \sigma$		cv %	$\bar{X} \pm \sigma$		cv %	$\bar{X} \pm \sigma$		cv %	$\bar{X} \pm \sigma$		cv %
Myristic (C14:0)	1.15	0.29	25	1.03	0.10	10	1.06	0.07	7	1.10	0.15	14
Palmitic (C16:0)	19.94	1.78	9	17.88	1.18	7	18.64	1.02	5	18.35	1.90	10
Palmitoleic (C16:1)	0.47	0.10	21	0.43	0.04	9	0.45	0.06	13	0.43	0.08	19
Cis Palmitoleic (C16:1cis)	1.62	0.32	20	1.81	0.22	12	1.70	0.12	7	1.75	0.20	11
Heptadecanoic (C17:0)	0.28	0.05	18	0.21	0.02	10	0.22	0.03	14	0.21	0.04	19
Heptadecenoic (C17:1cis)	0.17	0.06	35	0.23	0.06	26	0.18	0.05	28	0.19	0.06	32
Stearic (C18:0)	9.61	1.50	16	8.60	0.97	11	8.91	0.81	9	8.55	0.73	9
Oleic (C18:1)	41.32	1.10	3	42.75	0.57	1	43.17	1.50	3	43.59	2.06	5
Linoleic (C18:2)	19.88	1.40	7	20.21	1.75	9	19.67	1.26	6	19.44	1.24	6
Linolenic (C18:3)	1.62	0.29	18	2.26	0.50	22	1.83	0.23	13	1.98	0.47	24
Eicosenoic (C20:1)	1.11	0.14	13	0.76	0.59	78	0.90	0.43	48	0.93	0.45	48
Beenic (C22:0)	0.15	0.07	47	0.23	0.10	43	0.19	0.03	16	0.17	0.08	47
Erucic (C22:1)	0.24	0.10	42	0.50	0.11	22	0.27	0.13	48	0.26	0.14	54

†The following fatty acids: Myristoleic (C14:1), Arachic (C20:0), Arachidonic (C20:4), Lignoceric (C24:0) and Selacoleic (C24:1), even though determined, were not reported because their average percentage incidence was lower than 0.05.
††SI = inner layer.
†††SE = outer layer.

The fatty acids mostly represented in adipose tissue under examination (subcutaneous and perirenal) were: palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1) and linoleic acid (C18:2). Concerning these acids, the two types of adipose tissues were characterized by a different composition. Indeed, the subcutaneous adipose tissue presented a higher content of C18:1 and a lower content of C18:0 and C18:2 in comparison with the perirenal adipose tissue.

Table 1 shows: (i) oleic acid (C18:1) had a mean percentage value varying from a minimum of 41 in SI of SPT to a maximum of 44 in SE of SPL, the variation, expressed as variation coefficient (cv %), was between a minimum of 1 in SE of SPT and a maximum of 5 in SE of SPL (ii) linoleic acid (C18:2) had a mean percentage value ranging from a minimum of 19 in SE of SPT to a maximum of 20 in SE of the same sampling site, the cv (%) was between a minimum of 6 in SI of both layers of SPL and a maximum of 9 in SE of SPT (iii) palmitic acid (C16:0) had a mean percentage value varying from a minimum of 18 in SE of SPT to a maximum of 20 in SI of the same sampling site, cv (%) was between a minimum of 5 in SI of SPL and a maximum of 10 in SE of the same sampling site and (iv) stearic acid has a mean percentage value ranging from a minimum of 8 in SE of SPL to a maximum of 10 in SI of SPT, the cv % was between a minimum of 9 in both layers of SPL and a maximum of 16 in SI of SPT.

Examining Table 2 it can be evidenced that the mean percentage values were: (i) oleic acid (C18:1) 29% (cv % = 7) (ii) linolenic acid (C18:2) 27% (cv % = 11) (iii) palmitic acid (C16:0) 22% (cv % = 5) and (iv) stearic acid (C18:0) 14% (cv % = 11).

Table 2. Perirenal adipose tissue. Mean value, standard deviation and variation coefficient (cv %) of percentage incidence of some fatty acids†

Fatty acid	$\bar{X} \pm \sigma$		cv %
Myristic (C14:0)	1.24	0.23	19
Palmitic (C16:0)	21.64	1.19	5
Palmitoleic (C16:1)	0.51	0.28	55
Cis Palmitoleic (C16:1cis)	0.87	0.19	22
Heptadecanoic (C17:0)	0.40	0.10	25
Heptadecenoic (C17:1cis)	0.14	0.03	21
Stearic (C18:0)	14.30	1.57	11
Oleic (C18:1)	29.44	2.15	7
Linoleic (C18:2)	26.98	3	11
Linolenic (C 18:3)	1.10	0.17	13
Eicosenoic (C 20:1)	1.36	0.17	15
Beenic (C 22:0)	0.23	0.10	43
Erucic (C 22:1)	0.20	0.13	65

†The following fatty acids: Myristoleic (C14:1), Arachic (C20:0), Arachidonic (C20:4), Lignoceric (C24:0) and Selacoleic (C24:1), even though determined, were not reported because their average percentage incidence was lower than 0.004.

Therefore, the mean value and the individual variability showed a certain determinism of AAGT. The oleic, linoleic, palmitic and stearic fatty acids, in both sampling sites (SPL and SPT), contribute to acidic fraction of lipidic mean composition for 90%, value equal to 92% in perirenal adipose tissue.

Moreover, meanly, in perirenal adipose tissue oleic and linoleic acids content was lower (56%) than that present in subcutaneous adipose tissue (63). The major presence of oleic acid in adipose tissues suggests a major activity of stearoyl-CoA Δ^9 desaturase (Kouba *et al.*, 1997 Kouba and Mourot, 1998) that corresponds to a lower content of stearic acid in the same tissues. Comparing linoleic content in depot layers under examination, we deduce that it is present in similar content. This suggests that it is of exogenous source rather than derived from an enzymatic unsaturation.

Oleic and linoleic fatty acids are the most important unsaturated fatty acids they contribute to enrich the aromatic component (Shródter *et al.*, 1986 Ramarathnan *et al.*, 1991 Elmore *et al.*, 1999) and present a high nutritional power for their protective role against cardiovascular diseases (Hornstra, 1999). Saturated fatty acid, in particular palmitic and stearic, contribute for about 10% in both sites. As concerns UFA/SFA ratio, it results equal to 1.60 in perirenal adipose tissue, with 38% of

saturated fatty acid, while in subcutaneous adipose tissue such ratio results equal to 2.30, with 31% of saturated fatty acid moreover, independently from the sampling site, the outer layers present a major value of UFA/SFA ratio than inner ones. This acidic composition is in agreement with guidelines for a correct alimentation which suggest a decrease of saturated fatty acid intake. Indeed, in a correct dietary, according to the WHO rules (World Health Organization) for heart healthy, the recommended energy intake coming from saturated fatty acid should be major than 10% out of the total energy of dietary (FAO/WHO, 1998) with an UFA/SFA ratio higher than 2 (Capita and Alonso-Calleja, 2003).

However it must be highlighted that, even if saturated fatty acid *sensu latu* are involved in atherogenic and thrombogenic processes, not all of them express the same behaviour as regards the increase of serum cholesterol. Lauric (C12:0), myristic (C14:0) and palmitic (C16:0) SFAs showed a tendency to increase the hematic cholesterol concentration (myristic is more atherogenic) while there s a very high correlation between the sum of three acids (myristic, palmitic and stearic) and the thrombus formation (Ulbricht and Southgati, 1991).

Two distinct indexes were proposed: (i) atherogenic index (IA) and (ii) thrombogenic index (IT). These indexes take in account the different effects that the single fatty acid might have on human health and in particular on probability of increasing the incidence of pathogenic phenomena, such as atheroma and/or thrombus formation. However both these index are subjected to revision in relation to new experimental evidences.

Examining Table 3, in which atherogenic and thrombogenic indexes in adipose tissue under examination are reported, it can be evidenced that the value of both indexes is lower in Se than SPT. Moreover, the comparison with data reported by Franci *et al.* (2005) shows that the values of both indexes are lower in comparison with those observed in *Cinta Senese* (CS), Large White (LW) and LW x CS genetic types.

Table 3. Comparison between mean percentages of atherogenic and thrombogenic index in AAGT *Casertana*

Index	Sampling site				
	Thoracic (SPT)		Lumbar (SPL)		Perirenal
	SI	SE	SI	SE	
IA	0.39	0.32	0.35	0.38	0.5
IT	0.69	0.59	0.65	0.65	0.74

Other unsaturated fatty acids in the present study are represented by 2 of 8 isomers of conjugated linoleic acid (CLA), whose content is lower in perirenal adipose tissue (0.021%) in comparison with subcutaneous adipose tissue (0.26%). The presence of a fair content in CLA is notable since that a such category of PUFA, also at relatively low doses (0.5-1% of the diet) were proved to have an increasingly important role in the interfering positively with immune system and in the prevention of tumour, atherosclerosis and other diseases such as diabetes and obesity (Pariza *et al.*, 2001 Evans *et al.*, 2002).

Conclusions

Considering all that above explained, the unsaturated fatty acid content of adipose tissue contribute to define food obtained from AAGT under examination as "functional foods", particularly interesting from "nutritional" and "extranutritional" point of view. Unsaturated fatty acids, in addition to being essential components of plasmatic membranes, play a very important role in respiratory mechanics. Therefore pork meat must be considered in the same way of other food of animal and vegetal origin in human nutrition.

Considering the positive recognized influences of fatty acids as regards different diseases, acidic component of pork lipids in human nutrition is considered a "multifactorial" and "multifunctional"

reality, i.e. systemic this reality must be considered metabolically, and it must be underlined that a healthy and heterogeneous alimentation, able to guarantee a correct supply of main nutrients since young age, represents the best strategy in prevention and curing diseases, therefore conserving a physical, psychical and social welfare optimal but temporarily and spatially dynamic.

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Relation between conformation grade and different measurements of IGP Ternera de Navarra beef carcasses using computer image analysis

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SUMMARY – The relationship between the conformation score (SEUROP scale) and 32 morphologic measures of the carcass has been studied in 24 carcasses of young bulls of Pirenaica breed from the IGP Ternera de *Navarra*. Measures were made on 2 photographs of the carcass (lateral and dorsal) in the slaughter line. The measurements were made by an image analysis software. The results show that conformation score is positively correlated with weight (r = 0.58 P<0.05), area (r = 0.70 P<0.01) and compactness (r = 0.80 P<0.001) of the carcass. The highest value of correlation (r = 0.87 P<0.001) was obtained between the conformation score and measurement h, indicator of the degree of convexity of the round of the carcass. After a *step ise* regression analysis, in which the score of conformation was considered as dependent variable and the 32 morphologic measures as independent variables, the combination of 3 parameters from them explained 93% (r^2=0.93) of the variability of the conformation score. These results would show that the classification of the carcass according to conformation could be made by methods with higher objectivity than the current visual evaluation of the carcass in the SEUROP system.

Keywords: Beef carcass, conformation, image analysis.

R SUM – *"Relation entre la note de conformation et les différentes mesures che les carcasses de veaux sous IGP ernera de Navarra à l aide de l analyse d images par ordinateur". Dans 24 carcasses de veaux m les de race Pirenaica appartenant à l IGP* Ternera de Navarra *on a étudié la relation existant entre la note de conformation (échelle SEUROP) et diverses mesures morphologiques effectuées dans la carcasse. Ces mesures ont été de 2 et ont été effectuées sur 2 photographies de la carcasse (une latérale et une autre dorsale) prises dans la ligne d'abattage. Les mesures ont été effectuées par ordinateur par la technique d analyse d image. Les résultats obtenus montrent que la note de conformation a été positivement corrélée au poids (r 0, 8 P 0,0), surface (r 0,70 P 0,01) et compacité (r 0,80 P 0,001) de la carcasse. Aussi, on a obtenu une valeur de corrélation r 0,87 (P 0,001) entre la note de conformation et la mesure h, indicatrice du degré de convexité du tiers postérieur de la carcasse. On a effectué une analyse de régression step ise, dans laquelle on a considéré la note de conformation comme variable dépendante et les 2 mesures effectuées dans la carcasse comme variables indépendantes, et on a obtenu une combinaison de de ces paramètres qui expliquent 9 de la variabilité de la note de conformation (r^2 0,9). Ces résultats nous inclineraient à penser que la classification des carcasses selon leur conformation pourrait tre effectuée par des méthodes avec un plus grand degré d objectivité que le système SEUROP utilisé actuellement.*

Mo s s : *Carcasse bovine, conformation, analyse d'image.*

Introduction

In Europe conformation and fat cover are the main parameters for establishing the quality and the price of bovine carcasses. In order to grade carcasses for conformation score, SEUROP classification scale is used (EC 2237/1991). This system is based on the use of photographic patterns to grade carcasses in 6 classes according to their conformation. With the aim of becoming this system more faster, objective and automatic new classification systems are being developed in the last years based on the use of video image analysis at the moment of slaughter (f.e. BCC2 in Denmark Normaclass in France VBS-2000 in Germany and Viascan in Australia). These systems are based on the use of equations for predicting carcass yield from different measures made in the carcass. Besides artificial neuronal networks (Hill *et al.,* 2000) and artificial intelligence techniques (D az *et al*., 2006) are being applied to improve the accuracy of the estimation. However, depending on factors such as the specie, the genotype, the age, the accuracy of these equations could vary and perhaps the most precise equations for a specific market could not be appropriated for another different (Allen and Finnerty, 2000). The present work studies the relation between conformation score assigned

according to SEUROP system and different morphologic measures obtained by an image analysis software in bovine carcasses from yearling bulls raised under the IGP *ernera de Navarra* (O.F. 19/06/2000).

Material and methods

24 carcasses from Pirenaica young bulls from the *ernera de Navarra* IGP (379 12.8 kg of LW and 356 15.9 d of age) have been used. The animals were slaughtered at *La Protectora* slaughter house (Pamplona, Spain). The official graders of this slaughter house classified each carcass according to conformation score using SEUROP scale (subdivided each score in 3 subclasses, scale 1-18).

Previously, in the slaughter line two photographies were taken (Sony DSC-S75-S85 digital camera) from each carcass, one from the right lateral side and another one from the dorsal side (Fig. 1). Based on the anatomical measures described by de Boer *et al*. (1974), to characterize bovine carcasses, different lengths, perimeters, areas and diameters were determined by an image analysis software (Optimas V. 6.5 Media Cybernetics, USA) obtaining a whole of 32 measurements.

Fig. 1. Image of the right lateral side and dorsal image of the carcass in the slaughter line.

Pearson coefficients correlations between the conformation score (SEUROP scale, transformed to 1-18) and the considered 32 morphologic measures were calculated. A stepwise regression analysis between conformation score of each carcass and the different measures obtained by image analysis has been calculated for predicting the conformation score assigned to each carcass.

Results and discussion

The results show that there is a significant correlation coefficient between conformation score and carcass weight ($r = 0.58$ $P<0.05$). It agrees with the results obtained by Goyache *et al*. (2006) in young bulls of several Spanish breeds and it confirms that conformation improves with the development and growing of the animals. Conformation score showed a higher correlation coefficient with carcass area ($r = 0.70$ $P<0.01$) than with carcass weight.

In order to correct the influence that could have the weight or the area of the carcass over the assignation of conformation score, a new parameter was calculated, carcass compactness, that was

defined as the relationship between weight and length of the carcass (de Boer *et al.,* 1974). In the present work the correlations between this parameter and conformation score was r = 0.42 (P<0.10). Nevertheless, other parameters of compactness based on the profiles that carcass shows are interesting to check. One of them is defined by the equation: $C=0.28\ P/\sqrt{A}$, where P is the perimeter and A the area of the carcass. This compactness index would be 1 when the considered surface was a circle. When this index was used the correlation coefficient with conformation score was r = 0.71 (P<0.01), and when it was focus only on the round then it increased to r = 0.79 (P<0.001). Because of a bovine carcass resembles more a cylindrical shape than a spherical one and, in a bidimensional plane, more to a rectangle than to a circle, a more suitable index of compactness could be the proportion between the carcass area and the rectangle that would include that carcass (Fig. 2). The value of the correlations between the note of conformation and this new compactness index was 0.80 (P<0.001).

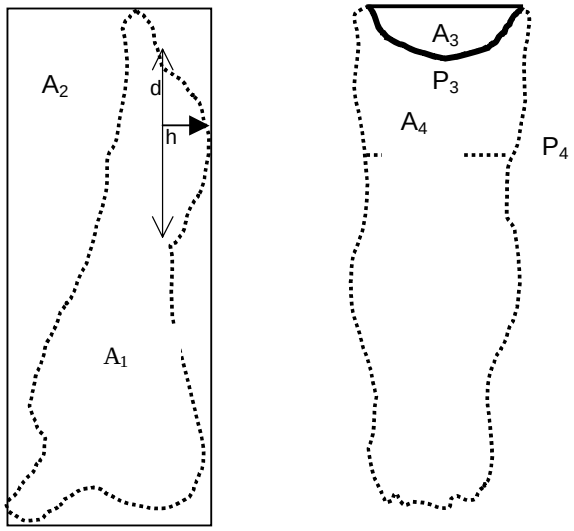

Fig. 2. More representative measures obtained in lateral and dorsal images of bovine carcass. A_1: area of the carcass A_2: area of the rectangle that frames the carcass A_3: area of the inside round A_4: area of the round P_3: perimeter of the inside round opening P_4: perimeter of the round d: distance between ends of the curvature of the round h: height until the vertex of the round.

Because of subprimal cuts with greater meat yield are located in the round and owing to the expert classifiers of the carcasses examine thoroughly this primal to grade carcasses according to conformation score, the measurements made in this region showed high correlations with conformation score. It is worth to emphasize the measurement h (Fig. 2) whose coefficient of correlation was 0.87 (P<0.001). This measurement would show the convexity of the leg and therefore, the degree of development or conformation of this anatomical region. In this sense, round compactness measured in the dorsal image ($C=0.28\ P_4/\sqrt{A_4}$ Fig. 2) showed a high correlation coefficient (r = 0.79 P<0.001) with conformation score too.

The results of the stepwise regression analysis show that the model that integrates 3 of the measured parameters measure h, the compactness of the carcass (A_1/A_2) and the compactness of the inside round opening (Fig. 2) in a prediction equation, explains 93% (RSD=0.34 units, in 1-18 score) of the total variability of conformation scores (Table 1).

When comparing these results with those of a previous experience, carried out in the same slaughter house with a group of more heterogeneous carcass from different breeds (Limousine, Blonde d Aquitaine and Pirenaica, mainly) which showed a conformation score range from S to R, the

prediction equation obtained explained 69% of the total variance in conformation score (Mendizabal *et al*., 2004). Therefore, the results of the present experience can be considered much more precise. This would indicate that when a slaughter plant slaughters a very defined type of carcass (in the present case carcasses from yearling bulls of Pirenaica breed) the graders have a very high accuracy in the grading, whereas when the range of carcass is bigger the accuracy in the classification decreases.

Table 1. Regression stepwise between the note of conformation (variable y) and the different morphological measures made in the carcass (variable x)

Step	V. Independent (x)	r^2	RSD
1	h	0.76	0.58
2	$Compactness_1$	0.90	0.40
3	$Compactness_2$	0.93	0.34

h: height until the vertex of the round $Compactness_1$: A_1/A_2 (A_1: area of the carcass A_2: area of the rectangle that frames the carcass) $Compactness_2$: $0,28*P_3/\sqrt{A_3}$ (P_3: perimeter of the inside round opening A_3: area of the inside round opening).

Conclusions

In summary, it is possible to state that in a close future automatic classification systems of classification of bovine carcass will be introduced and they will replace the visual grading. So it will be necessary to establish the equations of prediction based on the type of carcass produced in each market. In addition, these new systems will provide data concerning to the saleable meat yield and the meat quality if additional parameters as the colour and the marbling of meat are included.

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Sensory evaluation of several European cattle breeds

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SUMMARY – The present study is part of an EU project. In this paper we examine 211 young bulls from 11 different breeds representing the genetic diversity of European cattle. The objective was to determine the influence of breed (meat with 10 days ageing) on sensory characteristics of beef meat. All animals were fed ad libitum with a standard diet comprising barley, soya and chopped straw. Slaughter was about 15 ± 1 months of age. Meat was assessed by a Spanish trained taste panel. Results showed that breed was significant on the studied descriptors. Pirenaica animals (5.62) had the most tender meat and Simmental (4.38), Marchigiana (4.29) and Casina (3.94) the toughest. Limousin (5.30), Charolaise (5.24), Pirenaica (5.12) and Asturiana de los Valles (5.06) showed high scores in juiciness. The breeds with the highest flavour intensity were Asturiana de los Valles (5.40) and Pirenaica (5.38). The lowest score was for Simmental for both flavour (4.85) and juiciness (4.14).

Key words: Beef, meat quality, tenderness, juiciness, flavour.

RESUME – "Evaluation sensorielle de plusieurs races bovines européennes". Ce travail s'inscrit dans le cadre d'un projet européen qui porte sur la Génétique de la Qualité de la Viande. Dans cet article, nous avons étudié 211 taurillons issus de 11 races bovines représentant la diversité génétique des bovins en Europe. L'objectif était d'étudier l'effet de la race sur la qualité sensorielle de la viande après 10 jours de maturation. Les animaux ont été alimentés à volonté avec un régime à base d'orge et de tourteau de soja et avec de la paille hachée. Les animaux ont été abattus à l'âge de 15 mois. Les animaux de race Pirenaica ont produit la viande la plus tendre (5,62) alors que la viande la plus dure a été produite par les animaux de race Simmental (4,38), Marchigiana (4,29) et Casina (3,94). La jutosité la plus élevée a été observée pour la viande issue des races Limousine (5,30), Charolaise (5,24), Pirenaica (5,12) et Asturiana de los Valles (5,06). Les races qui ont produit la viande avec la flaveur la plus intense étaient l'Asturiana de los Valles (5,40) et la Pirenaica (5,38). La flaveur (4,85) et la jutosité (4,14) étaient les plus faibles pour la viande de la race Simmental.

Mots-clés : Viande bovine, qualité de la viande, tendreté, jutosité, flaveur.

Introduction

Improving animal performance, carcass characteristics and meat quality traits are the main objectives of most of the research carried out in the beef production area. Satisfying the consumer's requirement for a consistent satisfactory product is the major target of beef producers and retailers. Meat quality is an important criterion that influences the decision of a consumer to purchase beef. Many investigators studied the relation among different production factors (feeding plan, age, breed, etc.) and the sensory attributes (tenderness, juiciness, flavour, texture, colour).

Selective breeding in cattle has been very successfull in increasing production factors such as daily gain and feed efficiency. Until now there is limited information and subsequent little knowledge to allow selection programs to be designed to improve product quality. Identification of the genes involved in aspects of carcass and meat quality will provide the basic information to devise breeding programs that enhance quality.

The present study is part of an EU-project which examines young bulls from different breeds (both dairy and beef) that represent the genetic diversity of European cattle. The final objective of the project is to try to correlate genetics traits with meat quality traits. The aim of this paper was limited to the study of the influence of breed on the sensory characteristics of beef after 10 days ageing.

Material and methods

Two hundred and eleven young entire males from 11 different European cattle breeds were used: Asturiana de los Valles, Casina, Avileña-Negra Ibérica and Pirenaica from Spain Charolais and Limousin from France Holstein, Danish Red Cattle and Simmental from Denmark and Marchigiana and Piemontese from Italy. All animals were fed *ad libitum* with standardised diet comprising high barley (about 80%), soya (9%) and chopped straw (10%) with minerals and vitamins. Energy density was approximately of 12.5 kJ/kg dry matter.

All the welfare regulations were taken into account when handling the animals. Bulls were slaughtered in each country at the nearest EU licensed abattoir from the farm, to minimise the effect of the transport stress on meat quality. Slaughter was about 15 1 months of age. Stunning was made by captive bolt pistol. Carcasses were chilled at 4°C for 24 hours. After this time the *Longissimus thoracis* muscle (between 8^{th} and 13^{th} ribs) was removed from the left side of carcass and stored at 3°C 1°C for a further 24 h. This section was aged for 10 days, sliced in two-centimetre thick steaks, vacuum packaged and frozen at -18°C.

Prior to sensory analysis meat was thawed, in their vacuum bags, in tap water for 4 hours until reaching an internal temperature of 17-19°C. Meat was cooked on a pre-heated double hot-plate grill at 200°C, inside aluminium paper, until it reached 70°C of internal temperature. Then, they were cut in small portions (free of visible connective tissue), wrapped in coded aluminium paper and stored warm (50°C) until tasted.

Samples one by one were served to a Spanish trained nine-member sensory panel in individual booths under red lighting to mask differences in meat colour. Panellist rated the samples on an eight-point category scale for tenderness (defined as the opposite of the force required to bite through the sample with the molars), juiciness (amount of moisture released by the sample after the first two chews) and flavour intensity (flavour associated with the species).

Statistical analysis was performed using SPSS 13.0 software. A GLM procedure was carried out. Means were compared using the Tukey test.

Results and discussion

Global results are shown in Table 1. Significant effects were observed in all measured attributes: tenderness, juiciness and flavour.

Of all meat texture attributes, tenderness has been considered the most important meat quality characteristic for consumers (Love, 1994) and in agreement with Gregory *et al.* (1994), the main textural differences were found in tenderness values. Although ageing is considered main factor afecting tenderisation, it did not affect our samples since all breeds were aged for the same length of time. It has been shown that long ageing periods decrease differences in tenderness (Monsón *et al*., 2004). However, 10 days seems not long enough to avoid these differences.

Results showed that in general specialised breeds (beef and dairy breeds) had the highest values in tenderness. Eight breeds had scores higher than 5 points: Pirenaica, 5.62 Charolais, 5.39 Piemontese, 5.38 Avileña-Negra Ibérica, 5.35 Limousin, 5.32 Asturiana de los Valles, 5.22 Danish Red Cattle, 5.13 and Holstein, 5.07. Casina breed had the toughest meat (3.94).

Our results for tenderness in fast growing breeds (Pirenaica, Charolais) are similar to those obtained by Mac e *et al.* (2000) who observed that the breed had a big effect on tenderness and that the fast growing group reached the highest scores after seven and twenty one days of ageing.

Table1. Sensory characteristics on *m. Longissimus thoracis* after 10 days of ageing in 11 European cattle breeds†: means and (standard deviation)

	cas	marc	simm	hols	red	asv	lim	av	pie	char	pir
N	23	22	13	15	15	23	16	22	23	15	24
Tenderness††	3.94^{a} (1.59)	4.29^{ab} (1.23)	4.38^{ab} (1.09)	5.07^{bc} (0.81)	5.13^{bc} (0.65)	5.22^{bc} (1.18)	5.32^{bc} (0.80)	5.35^{bc} (1.14)	5.38^{bc} (0.91)	5.39^{bc} (0.78)	5.62^{c} (0.99)
Juiciness†††	4.40^{ab} (0.85)	4.37^{ab} (0.87)	4.14^{a} (0.88)	4.38^{ab} (0.76)	4.71^{abc} (0.63)	5.06^{bc} (0.84)	5.30^{c} (0.86)	4.89^{abc} (1.01)	4.71^{abc} (0.78)	5.24^{bc} (0.73)	5.12^{bc} (0.98)
Flavour††††	5.22^{ab} (0.41)	5.18^{ab} (0.33)	4.85^{a} (0.54)	5.02^{ab} (0.29)	5.06^{ab} (0.37)	5.40^{b} (0.38)	5.17^{ab} (0.29)	5.19^{ab} (0.45)	5.10^{ab} (0.34)	5.24^{ab} (0.38)	5.38^{b} (0.36)

†cas: Casina marc: Marchigiana simm: Simmental hols: Holstein red: Danish Red Cattle asv: Asturiana de los Valles lim: limousin av: Avileña-Negra Ibérica pie: Piemontese char: Charolais pir: Pirenaica.
††Tenderness: 1, very tough – 8, very tender.
†††Juiciness: 1, very dry – 8, very juicy.
††††Flavour: 1, very low intensity – 8, very high intensity.
^{a,b,c}Different letters in the same row mean significant differences ($p < 0.05$).

Some animals of the Piemontese or Asturiana de los Valles breeds presented the double-muscling genotype, which induces more glycolytic muscle fibres (Hanset *et al.*, 1982) and a lower collagen content (Bailey *et al.*, 1982). This could explain the high tenderness score of these breeds. However the effect of double-muscling on meat toughness is complex. Most of the literature described double-muscled animals with a higher tenderness, although Uyterhaegen *et al*. (1994) reported that cooked meat from double-muscled bulls of Belgian Blue breed had significantly higher shear force than meat from normal animals.

A higher precocity as for milk breeds (Danish Red Cattle, Holstein) could influence in the results since a high intramuscular fat content decreases the muscle resistance to shearing (in instrumental analysis) because of dilution of fibrous protein by soft fat (Wood *et al*., 1999).

Meat juiciness is an important contributor to eating quality and plays a role in meat texture (Dransfield *et al*., 1984). The relationship between tenderness and juiciness have been reported in several studies (Crouse *et al.*, 1985 Destefanis *et al*., 2000) with correlation coefficients ranging between r = +0.42 and r = +0.88. The more tender the meat, the more quickly water is released by chewing and the more juicy the meat is perceived (Cross, 1988).

In juiciness, Limousin breed (5.30) had the highest score. Charolais (5.24), Pirenaica (5.12) and Asturiana de los Valles (5.06) breeds had a high score too, following the similar direction as tenderness. Campo *et al.* (1999) found that specialised beef breeds had the highest scores although the differences appeared after 14 days ageing.

With respect to flavour the differences were more reduced. Asturiana de los Valles breed (5.40) and Pirenaica breed (5.38) obtained the highest scores, while Simmental being the breed with the lowest score (4.85). Only between these breeds the effect was statistically significant. So, as was found by Dikeman and Crouse (1975), the breed was not an important effect in flavour intensity. Although it can exist important differences between the animals of our study in intramuscular fat content, the lack of significant differences in flavour intensity could be explained by the higher contribution of the lipid fraction to the species-specific flavour (Wasserman and Talley, 1968) than to the total perceived flavour (which depends itself on a much high number of components). Nevertheless Renand *et al*. (2001) described positive correlations between lipid content and flavour intensity in steaks at 6 and 15 days *post mortem* of Charolais young bulls (slaughtered at 17 months). But flavour depends on several precursors that react during cooking within these compounds, phospholipids play a major role in meat flavour (Mottram and Edwards, 1983) and they can be changed through the diet. Since all animals were reared in similar intensive conditions, these differences may have dissapeared.

Conclusion

The wide variety of breeds in Europe produces meat that can be differentiated by its organoleptic properties. Breed was significant on the studied descriptors although it impacted more on texture parameters. At 10 days of ageing, unimproved breeds are tougher than beef or dairy breeds. Flavour was less affected by breed, mainly due to the similar intensive rearing conditions of all of them.

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Fat colour, a traceability parameter of grass feeding in lambs

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SUMMARY – Fifty Rasa Aragonesa light male lambs were submitted to one of the following four experimental treatments: Grazing (Gr), Grazing with supplement (Gr+S), Indoor (Ind) and Indoor-Grazing (Ind-Gr). The aim of this study was the use of fat colour to trace the different feeding systems, a specially grazing-fed vs indoors-fed. Muscle L. thoracis and perirenal fat colours in the CIELab space were measured with a spectrophotometer CM 2600d and the integral of the translated spectrum, as fat absolute value, was calculated. Data values were subjected to analysis of variance, a discriminant analysis, and a binary logistic regression. Meat from lambs reared under indoor systems showed a lighter colour and a sharp blooming 24 hours later. Fat from forage-fed lambs was lighter and more yellow. Discriminant analysis was able to classify them with 55% accuracy in the four treatments. However, it is confused when the classification must be done within feeding systems (Gr vs Gr+S and Ind vs Ind-Gr). A logistic regression classified 100% of lambs into the two feeding systems. Therefore, this regression can be used in on-line classification.

Keywords: Grazing, meat, fat, colour.

R SUM – "La couleur du gras, un paramètre de traçabilité chez les agneaux broutardes". Cinquante agneaux mâles de poids léger et de race Rasa Aragonesa ont été soumis à un des quatre traitements suivants: Pâturage (Gr), Pâturage supplémenté (Gr+S), Stabulation (Ind), et Stabulation-Pâturage (Ind-Gr). L'objectif de ce travail a été l'utilisation de la couleur de la graisse pour tracer les différents systèmes d'engraissement: Pâturage vs Concentré. La couleur du muscle L. thoracis et de la graisse périrénale a été mesurée au CIELab espace avec un spectrophotomètre CM 2600d, et on a calculé la valeur de l'intégrale du spectre transporté comme étant la valeur absolue de la graisse. Les données ont été traitées avec les analyses de variance et discriminante, et la régression logistique binaire. La viande d'agneaux élevés en stabulation était plus claire et avait une nette couleur rouge 24 heures après. La graisse des agneaux soumis au pâturage était plus lumineuse et jaune. L'analyse discriminante avait la capacité de différencier avec 54% de réussite entre les quatre traitements. Cependant, la classification a été confuse dans les systèmes d'alimentation (Gr vs Gr+S et Ind vs Ind-Gr). Une régression logistique arrive à classifier 100% des animaux par systèmes d'alimentation. Par conséquent, cette régression peut être utilisée pour la classification "on line".

Mo s s : Pâturage, viande, graisse, couleur.

Introduction

Meat from grass-fed lambs is different from concentrate-fed lambs in chemical composition, especially fatty acids (Wood et al., 2003), flavour (Sañudo et al., 2000), tenderness and colour (Coulon and Priolo, 2002). These differences are more pronounced according to the feed management before slaughtering (Priolo et al., 2002). Now, consumers demand increasing clear information about the feeding system and food supply used to rear meat animals, specially that included in "labelled category", as Organic meat or Protected Geographical Indications. The possibility to trace food supply is important to guarantee that producers respect the feeding conditions of the labelled meat sold at the market. Carotenoids are characteristic micronutrients of plants and their presence in animal tissue means green herbage intake. These pigments are stored in fat tissues and can be measured by colorimetric method according to Prache and Theriez (1999). Therefore, the content of this parameter can be a good marker to predict grass feeding.

The aim of this study is to measure the effect of green forage on meat and fat colour parameters as well as evaluate whether the colour of fat tissue can be used to discriminate between lamb meats obtained in different production systems, specially grazing-fed vs indoor-fed.

Material and methods

Fifty Rasa Aragonesa male lambs were used in this study. Lambs were randomly allocated to one of four experimental treatments: (i) Grazing (Gr), ewes and lambs (n = 13) remained at alfalfa meadows and lambs did not have access to concentrate (ii) Grazing with supplement (Gr+S), ewes and lambs (n = 12) remained at alfalfa meadows and lambs had *ad libitum* access to concentrate (iii) Indoor (Ind), ewes were permanently inside with *ad libitum* access to a total mixed ration and lambs (n = 13) fed with ewe milk and concentrate *ad libitum* and (iv) Indoor-Grazing (Ind-Gr), ewes grazing at grass meadows from 08:00 h to 16:30 h and remaining indoors with lambs (n = 12) the remaining time. Lambs were fed with ewe milk and concentrate *ad libitum*. Lambs from Ind and Ind-Gr treatment were weaned at 41±3.96 days old, whereas lambs from Gr+S and Gr lots remained with their dams in meadows until slaughtering. Concentrate offered had 175 g CP/kg DM and 1.36 UFL/kg DM. Lambs were slaughtered when they reached 22-24 kg live-weight according to the specifications of Ternasco de Aragón Protected Geographical Indication (Regulation (EC) No. 1107/96). Carcasses were chilled 24 hours at 6 C and then pH was measured at *M. Longissimus lumborum* (4^{th} vertebral region) with pH-meter equipped with a Crison 507 penetrating electrode.

Samples of *M. Longissimus thoracis* were taken from the 11-13 ribs to measure the muscle colour at cutting time and after 24 h of air exposure. These samples were overwrapped with oxygen-permeable film without contact with meat surface, and stored at 4 C in absolute darkness. Values were recorded on two locations randomly selected from the cranial surface of each piece to obtain a representative mean value. Colour was measured using a spectrophotometer Minolta CM-2600d in the CIELAB space (CIE, Commission Internationale de L Eclairage, 1976) with 8 mm measured area diameter, specular component included and 0% UV, standard illuminant D65 that simulates day light (colour temperature 6504 K), angle 10 and zero observer and white calibration. The lightness (L*), redness (a*) and yellowness (b*) were recorded, and hue angle (h*) and saturation index (C*) were calculated as h* = arctan (b*/a*)*57.29 and $C^* = \sqrt{a^{*2} + b^{*2}}$ (Albert *et al.*, 2005 Boccard *et al.*, 1981). Higher saturation indexes represent a more vivid colour and denote lack of greyness (Miltenburg *et al.*, 1992) and hue angle refers to the gradation of pure colour from red through yellow, green and blue, determined by the predominant wavelength of light. The spectral difference between the reflection values at 630 nm and 580 nm ($R_{630-580}$) was used as an index of oxymyoglobin content on the meat surface (Renerre, 1982) and its relation with meat visual acceptability (Renerre and Mazuel, 1985) with greater values indicating a more desirable red colour.

Fat colour was determined in perirenal (PR) area 24 hours *post mortem*. Each colour values were recorded at three locations randomly selected avoiding blood blots, discolorations, and less covered areas. Besides trichromatic coordinates, the proportion of reflected light every 10 nm between 450 and 510 nm was collected and the absolute value from the integral of the translated spectrum (Sum) was calculated according to Priolo *et al*. (2002).

Data values were subjected to analysis of variance using the GLM procedure of SAS (2005) to evaluate the effect of management system, time of oxygenation and its interactions. A forward stepwise discriminant was made for perirenal fat with L*, a*, b*, C*, h* and Sum as evaluated variables. The same variables of perirenal fat were included in a forward stepwise binary logistic regression.

Results and discussion

Values of pH were not affected by system management, with 5.5±0.08 mean values. System management only had a significant effect (P<0.05) on muscle *L. thoracis* on lightness (L*), while there was no effect on redness, yellowness, chroma, hue and $R_{630-580}$ (P 0.05) (Table 1). Oxygenation time had an effect of increasing values in most of the colour parameters, like L* and h* (Fig. 1), except for a* values in Gr (from 11.71 to 11.42) and Gr+S (from 11.22 to 11.94), while Ind and Ind-Gr increased meat redness from 9.61 to 12.05 and from 9.38 to 12.31, respectively.

As Fig. 1 shows, the L* values of both indoor treatments (Ind and Ind-Gr) were always greater than the grazing groups (Gr and Gr+S), at each time of measurement. Twenty-four hours after cutting time, L* and h* values were higher than at cutting, the behaviour being similar between main groups of treatment, (feeding system grazing *vs* indoor).

Table 1. Effects of management system and oxygenation time and their interaction on lamb Longissimus dorsi colour (F values)

	Lightness (L*)	Redness (a*)	Yellowness (b*)	Chroma (C*)	Hue (h*)	$R_{630-580}$
Management system	6.12**	1.79ns	0.07ns	0.76ns	0.67ns	0.26*
Time	126.02***	35.40***	156.46***	117.67***	73.84***	0.20ns
System x time	0.13ns	9.54***	1.45ns	4.27*	1.40ns	0.04*

ns: no significant; *:P<0.05; **P<0.01; ***P<0.001.

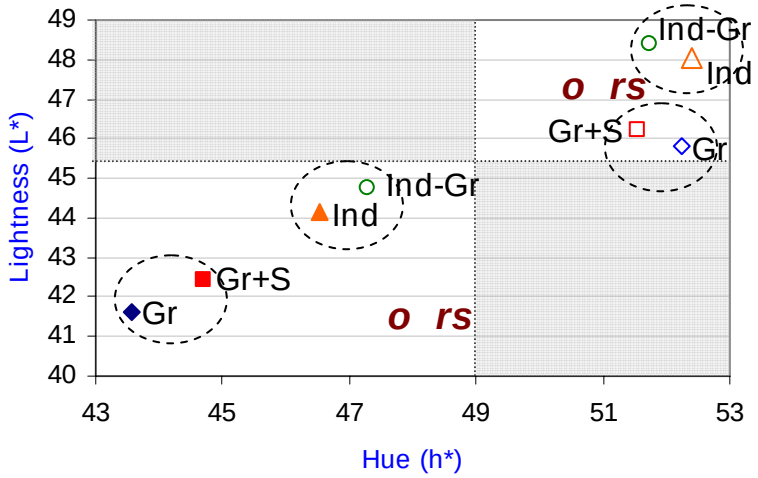

Fig. 1. Relation of lightness and hue values, at cutting time (0 hours) and 24h later, of L. thoracis from lambs submitted to four treatments: grazing (Gr), grazing and supplementation (Gr+S), indoor (Ind) and indoor with ewes grazing 8 hours (Ind-Gr).

Significant interactions (P<0.05) were found between time of oxygenation and management system for $R_{630-580}$ .The acceptability of L. thoracis at cutting time was similar in all treatments. However, 24 hours later, meat from Gr treatment had a significant lower value of $R_{630-580}$ (P<0.05) than Ind and Ind+Gr (Fig. 2). As in redness values, the acceptability of both indoor treatments increases with time, while Gr group decreases and Gr+S did not change with increasing time. The low values of $R_{630-580}$ in meat from grazing systems (Gr and Gr+S) may be due to lower conversion from myoglobin to oxymioglobin in grazing groups due to grass antioxidants.

Values of perirenal fat colour are showed in Table 2. Management system had an effect (P<0.05) on L* and C*. Yellowness (b*) and Sum values are significantly (P<0.001) greater in grazing systems. Gr and Gr+S had lighter, more yellow and saturated fat colour than Ind and Ind-Gr, although Gr had not significant differences with any group in L*. There was a significant effect of feeding management on Sum, with absolute values greater when lambs were grass-fed (Gr and Gr+S) than indoor-fed (Ind and Ind-Gr) as a result of the greater area included between the abscissas axis and the translated spectra (Fig. 3), which agrees with Priolo et al. (2002).

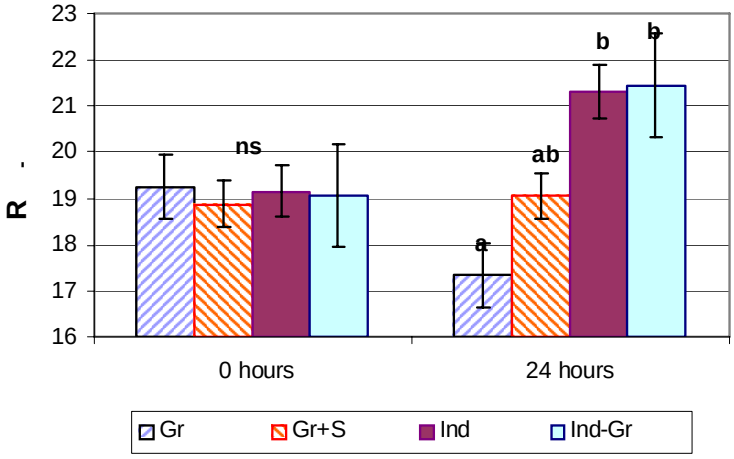

Fig. 2. Acceptability of *L. thoracis* from lambs submitted to four treatments: grazing (Gr), grazing and supplementation (Gr+S), indoor (Ind) and indoor with ewes grazing 8 hours (Ind-Gr).

Table 2. Perirenal fat parameters colour and value of the translated spectrum (Sum) integral

	Gr	Gr+S	Ind	Ind-Gr	F value
L*	75.38^{ab}	77.33^{a}	72.81^{b}	74.19^{b}	3.99*
a*	3.02	3.29	2.61	2.57	0.85ns
b*	13.29^{a}	13.48^{a}	10.51^{b}	10.59^{b}	7.46***
C*	13.68^{a}	13.92^{a}	10.88^{b}	10.93^{b}	6.89**
h*	77.40	76.90	75.84	76.72	0.21ns
Sum	253.28^{a}	257.00^{a}	110.28^{b}	118.91^{b}	23.86***

Different superscript in a row means significant differences.
ns: no significant *P<0.05 **P<0.01 ***P<0.001.

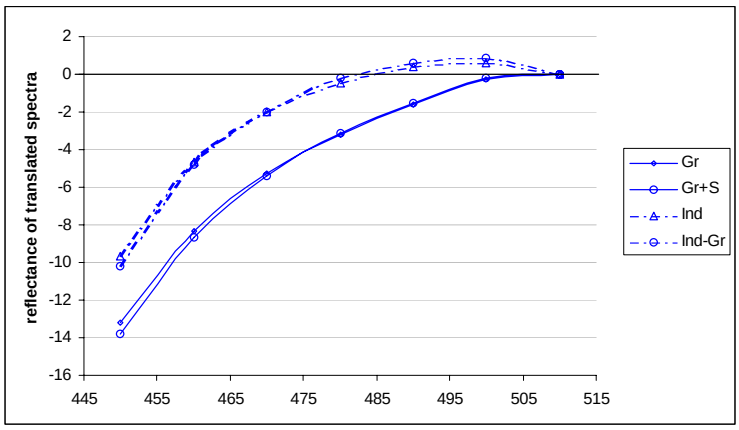

Fig. 3. Reflectance spectrum of perirenal fat at 24 hours *post mortem*.

When a discriminant analysis was made for fat variables, Sum and Chroma were selected to classify correctly 54% of the cases (Table 3). The analysis is able to discriminate between grass-fed

lambs (Gr and Gr+S) and indoor-fed ones (Ind and Ind-Gr). However, it is confuse when the classification must be done within one of the two main groups of treatments: grazing (Gr *vs.* Gr+S) and indoor (Ind *vs*. Ind-Gr). In addition, a low percentage of cases of grazing group are erroneously classified in Ind-Gr group, probably due to the influence of grazing on ewes in this treatment.

Table 3. Discriminant classification (%) for perirenal fat

Group	Foreseen membership			
	Gr	Gr+S	Ind	Ind-Gr
Gr	53.8	30.8	0.0	15.4
Gr+S	41.7	50.0	0.0	8.3
Ind	0.0	0.0	46.2	53.8
Ind-Gr	8.3	0.0	50.0	41.7

However, when grass-fed and indoor-fed were regrouped into alfalfa-fed (A) or non-alfalfa-fed (NA), and the following logistic regression was applied to determine the probability of a lamb to belong to a NA treatment (PNA), 100% of lambs were correctly classified.

$$P_{NA} = \frac{e^{-590.3-2.8\cdot Su+8.4\cdot L^*+37.5\cdot b^*}}{1+e^{-590.3-2.8\cdot Su+8.4\cdot L^*+37.5\cdot b^*}}$$

The use of spectrophotometers complemented with this kind of mathematical expressions is an easy ready-made on-line tool to trace grass fed systems.

Conclusions

Meat from lambs reared under indoor systems (Ind and Ind+Gr) presented a lighter colour in both cases and had a sharp blooming 24 hours later. Fat from grass-fed lambs (Gr and Gr+S) had a lighter colour, more yellow than that from indoor systems. Colour parameter is a good tool to classify animals from indoor-fed to grass-fed. However, it does not obtain a reliable classification within each of the two feeding systems (grazing-fed *vs* indoor-fed)

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Etude de la qualité du lait des ovins laitiers en Tunisie

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RESUME – Dans le but de caractériser le lait de brebis, on s'est intéressé à analyser et comparer les performances qualitatives du lait produit par deux races ovines laitières : la Sicilo-sarde et la Comisane élevées dans l'Agro-Combinat Ghézala, Mateur. Le troupeau Sicilo-sarde compte un effectif de 80 brebis âgées en moyenne de 5,6 ans et ayant un poids vif moyen de 45 kg. Quant au troupeau Comisane, l'effectif est autour de 150 brebis ayant un âge moyen de 4,8 ans et un poids vif moyen de 50 kg. Les deux races sont élevées en système semi-intensif (pâturage sur chaumes et fourrages verts durant 6 mois et fourrages conservés et concentré pendant le reste de l'année) et conduites en lutte de printemps aboutissant à des mises-bas automnales (septembre-octobre). La traite est réalisée deux fois par jour dans une salle de traite mécanique en épi 2x24. Pour étudier la qualité physico-chimique du lait, un prélèvement du lait de mélange par race a eu lieu une fois/semaine durant cinq mois. Les mesures de la densité, pH et acidité titrable ont eu lieu immédiatement après la traite alors que l'analyse de la composition chimique a eu lieu sur les échantillons conservés au laboratoire de technologie de l'Ecole Supérieure d'Agriculture de Mateur. Les résultats de la composition physico-chimique du lait ont montré que pour les deux races, il n'y a eu aucune différence significative ($p < 0,05\%$) pour l'EST, ESD, MG, MO, MM, ANP, ANC, lactose, densité, acidité titrable et pH. Cependant, le lait de la Sicilo-sarde est plus riche en caséines (51,6 g/l) que celui de la Comisane (49,7 g/l).

Mots-clés : Lait, qualité, ovins, Sicilo-sarde, Comisane.

SUMMARY – "Study of milk quality in dairy sheep in Tunisia". Milk yield and contents were studied for two dairy sheep breeds: the Sicilo-sarde and the Comisane. Both breeds are kept under the same management conditions in the Agro-Combinat Ghézala firm in Mateur, in the north of Tunisia. There were 80 and 150 Sicilo-sarde and Comisane ewes. Average age and weight were 5.6 and 4.8 years and 45 and 50 kg for the Sicilo-sarde and Comisane, respectively. Milk collected from two milkings/day by an automatic machine was measured and samples were taken to immediately determine density, pH, and titrable acidity. Refrigerated samples were then used to determine milk contents in TDM, fat, OM, NPN, and NCN. The Comisane breed produced more yield (0.4 l/d) than the Sicilo-sarde breed (0.3 l/d). However, milk contents, pH, density, and titrable acidity were similar for both breeds except for casein which was greater ($p < 0.05$) in the milk of Sicilo-sarde than in that of Comisane (51.6 vs 49.7 g/l). Production levels can be increased for both breeds if management is improved.

Key words: Milk, quality, sheep, Sicilo-sarde, Comisane.

Introduction

Dans le présent travail on se propose d'analyser et de comparer les résultats de la qualité du lait de deux races ovines laitières, la Comisane (CS) et la Sicilo-sarde (SS) élevées à la ferme "Bakhraya" rattachée à l'Agro-Combinat Ghézala (AC Ghézala) sise dans la région de Mateur. L'AC Ghézala se localise dans le bassin d'Ichkeul. Elle s'étend sur une superficie totale de 5589 ha dont les cultures fourragères occupent une place importante dans l'objectif de satisfaire les besoins alimentaires des troupeaux (bovins laitiers, ovins laitiers et ovins à viande). La région de Mateur appartient à l'étage bioclimatique subhumide avec une pluviométrie moyenne annuelle de 544 mm.

Matériels et méthodes

Animaux

Notre étude est effectuée sur les deux races ovines laitières : la CS introduite au AC Ghézala depuis 1991 et la race SS qui date depuis la période coloniale conduites dans un même troupeau. L'effectif des deux races est respectivement de 150 et 80 brebis pour les races CS et SS. Quant à l'âge moyen, il est de 4,8 et 5,6 respectivement pour la CS et la SS. Le poids moyen des brebis est de 50 kg pour la CS et 45 kg pour la SS.

L alimentation

Le cheptel ovin laitier de la ferme est conduit en semi-intensif. L alimentation est essentiellement basée sur le p turage (chaumes de céréales, chaumes de foin et d ensilage, avoine, fétuque) avec une complémentation base de foin et de concentré la bergerie. L eau est volonté. Les analyses de la composition chimique des aliments (AOAC, 1975) sont récapitulées dans le Tableau 1.

Tableau 1. Composition chimique des aliments

Aliments	MS (%)	MAT (%)	CBT (%)	MM (%)	MO (%)	PDIE	PDIN	UFL	CUD
Fourrages verts									
Avoine	15,9	15,9	26,9	13,9	86,1	51,0	110,0	0,81	55,2
Fétuque	27,8	8,0	33,0	9,8	90,2	53,0	55,0	0,68	51,8
Ray gras	15,3	17,6	18,2	19,3	80,7	48,0	122,0	0,88	63,2
Fourrages foin avoine	86,0	6,6	41,3	8,8	91,2	54,0	46,0	0,53	47,5

B timents et équipements

Les brebis sont logées dans une bergerie orientée contre les vents dominants, formée par une partie couverte pour abriter les animaux pendant la nuit et contre les agressions climatiques et une partie non couverte qui sert comme aire d exercice. La densité est de 1,38 m^2/brebis suitée. uant aux béliers, ils logent dans un b timent loin de celui des femelles de 1,5 km et ce durant toute l année. La salle de traite est en épi de type "Alpha Laval" 2x24 qui date depuis 1995. L existence d une aire d attente permet d organiser le déroulement de la traite dans cet élevage. Les animaux ont leur disposition des r teliers en fer servant pour la distribution du fourrage grossier, des mangeoires en béton fixées contre le mur pour la distribution du concentré et des abreuvoirs en acier (demi f ts).

Contr le laitier

Notre travail est basé sur les documents techniques disponibles au bureau d élevage (campagnes 2003/2004 et 2004/2005) de l exploitation et sur les données du contr le de performances réalisées par l Office de l levage et des P turages (OEP). Durant la période de l essai, les brebis de chaque race entrent séparément dans la salle de traite pour pouvoir évaluer les quantités produites par race. Afin de déterminer les qualités physico-chimiques des laits des deux races ovines étudiées, notre démarche consiste effectuer un prélèvement par race chaque semaine durant la période janvier-mai 2005. La mesure de la densité, du pH et de l acidité titrable a été faite juste après la traite sur le lait de mélange de chaque race. L analyse de la composition chimique, extrait sec total (EST), matière grasse (MG), minéraux (MM), azote non caséique (ANC) et azote non protéique (ANP), de ces échantillons du lait été faite au laboratoire de l ESA Mateur.

Analyse statistique

Les performances moyennes déterminant la variation de la composition physico-chimique du lait (MG, EST, ANP et ANC) des deux races ont été comparées par la plus petite différence significative au degré d incertitude de 5% suite une analyse de la variance un facteur.

R sultats et discussion

Bilan d agnelage

L étude des paramètres technico-économiques sur les deux campagnes nous a permis de ressortir le niveau de conduite technique des troupeaux :

(i) Taux de fertilité – il est d environ 88% pour les deux races. Ce taux n est pas loin des recommandations pour les races ovines tunisiennes qui sont de 90%.

(ii) Taux de prolificité – pour la CS, ce taux est de l ordre de 138, inférieur la norme de la race qui est de 180%. Alors que pour SS, ce taux dépasse la norme qui est de 120% pour atteindre un taux de 165% durant cette campagne.

(iii) Taux de fécondité – pour la SS, il est respectivement de 105 et 145 pour les campagnes 2003/2004 et 2004/2005. Alors que pour la CS, il est respectivement de 112,9 et 122 pour les mêmes campagnes étudiées.

(iv) Taux d avortement – pour la campagne 2004/2005, il est nul pour les deux races.

(v) Taux de stérilité – il varie de 12 18% chez les brebis de race SS et de 11 16% pour les brebis de race CS. Cette stérilité élevée par rapport la norme pourrait être imputée l ge assez avancé des béliers surtout de race CS, la non séparation des antenaises et des brebis durant la période de la lutte, la présence de brebis gées dans les troupeaux et la réforme non sévère.

(vi) Taux de mortalité – ce taux varie de 0 7% pour les deux races durant les deux dernières campagnes, on note une diminution du taux de mortalité des jeunes de race CS de 50% par rapport la dernière campagne et les résultats de la SS sont encourageants vu l absence de mortalité des jeunes en 2004/2005. Les cas de mortalité enregistrés pour la campagne 2003/2004 sont le résultat d un bilan énergétique déficitaire durant les derniers mois de gestation (le steaming n a pas été bien appliqué).

(vii) Taux de productivité numérique – c est le taux le plus important par rapport tous ceux précédemment analysés. Durant les deux campagnes étudiées, il est dans les normes pour les deux races (118% pour la CS et 145% pour la SS). Cependant, ce taux est meilleur pour la race SS car elle a présenté des taux de mortalité et de fécondité meilleurs que ceux de la CS pour la campagne 2004/2005.

Croissance des agneaux

Les paramètres de croissance mesurés sont les poids aux ges types de 10, 30 et 70 jours. Les gains moyens quotidiens (GM 10-30 et GM 30-70) sont ensuite déterminés. Le premier critère (GM 10-30) est un indicateur de la valeur laitière de la brebis alors que le GM 30-70 présente une expression du potentiel propre de croissance de l agneau. Au niveau de l exploitation, on accorde beaucoup plus d importance au GM 10-30 puisqu il s agit de races laitières. Les GM 10-30 des produits des deux races au cours des deux dernières campagnes sont donnés dans le Tableau 2. Les résultats de croissance des agneaux traités selon le sexe et le mode de naissance montrent que les agneaux doubles manifestent des croissances inférieures celles des simples et les m les gagnent plus de poids que les femelles. Cette tendance confirme celle trouvée par Khaldi (1980). En comparant les deux races, on constate que les agneaux de la race CS réalisent des GM supérieurs ceux de la race SS.

Tableau 2. GM 10-30 des agneaux et des agnelles des races Comisane et Sicilo-sarde (g)†

		111	211	121	221	112	122	212	222
2003/2004	Comisane	214	139	107	121	151	129	144	133
	Sicilo-sarde	123,5	111	83	88,5	137,5	103	132,25	116,75
2004/2005	Comisane	135	154	132,5	112	142	129	130	130
	Sicilo-sarde					140	126	125	124

†111 : m le simple issu d une brebis primipare 211 : femelle simple issu d une brebis primipare
121 : m le double issu d une brebis primipare 221 : femelle double issu d une brebis primipare
112 : m le simple issu d une brebis multipare 122 : m le double issu d une brebis multipare
212 : femelle simple issu d une brebis multipare 222 : femelle double issu d une brebis multipare.

La production laitière

Les courbes de lactation pendant la traite des brebis CS et SS obtenues par le contr le de performances sont représentées dans la Fig. 1. On remarque que la période de traite débute pour les deux races au mois de novembre et s étale vers le mois de mai. Pour une même durée de traite, on constate que la race CS est plus productive que la race SS. La production laitière / brebis présente / jour (PL/BP) en début de traite est jugée faible pour les deux races cause du sevrage. La production laitière moyenne par brebis présente pour la race SS est 0,3 l. Ce niveau de production est inférieur celui trouvé par Atti et Rouissi (2003) sur les ovins SS s alimentant de fourrages verts et de concentré. Pour la race CS, il est de 0,4 l. On peut remarquer que la production laitière augmente progressivement après le début de la traite exclusive pour atteindre un pic de production puis commence diminuer jusqu au tarissement.

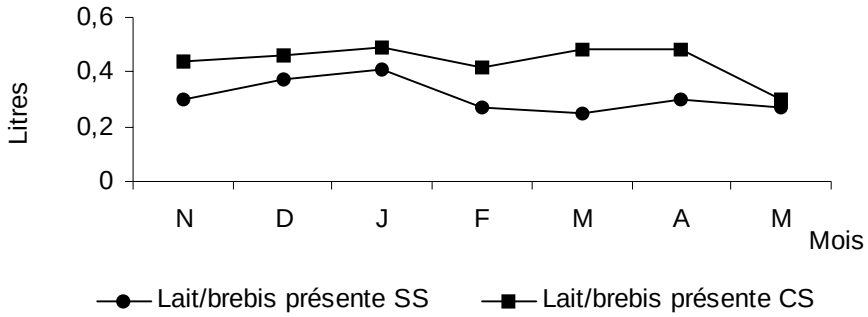

Fig. 1. Répartition de la production laitière par race (Sicilo-sarde : SS, Comisane : CS) et par brebis présente.

Pour étudier la qualité moyenne du lait des deux races étudiées, il est nécessaire de dégager les différents critères physico-chimiques déterminant cette qualité. Les résultats représentés dans le Tableau 3 sont les moyennes d analyses effectuées sur 28 échantillons de lait. Il ressort que la composition du lait est comparable pour les deux races l exception des teneurs en MAT (Tableau 3).

Tableau 3. Comparaison des critères physico-chimiques du lait de la Sicilo-sarde et de la Comisane

Variables†	Sicilo-sarde			Comisane			Pr F
	Moy	Min	Max	Moy	Min	Max	
EST (g/l)	189,8	174	208	191,1	177	211	0,572
ESD (g/l)	115,0	106	123	115,1	103	126	0,972
MG (g/l)	74,9	62	90	76,0	64	88	0,204
MO (g/l)	179,4	164	199,1	180,2	166	196,4	0,729
MM (g/l)	10,4	8,8	13,5	10,7	8,9	14,6	0,522
NT (g/l)	10,6	9,9	12,0	10,3	9,3	11,5	0,0004
ANP (g/l)	0,43	0,40	0,47	0,42	0,34	0,53	0,333
ANC (g/l)	2,59	2,38	2,83	2,5	2,4	2,8	0,066
MAT (g/l)	65,5	60,79	74,25	64,0	61,33	71,2	0,005
Caséines	51,6	46,38	58,08	49,7	43,63	56,4	0,007
Lactose	38,9	32,1	46,3	40,5	29,4	49,0	0,461
Densité	1034,7	1031	1037	1037,5	1035	1040	0,0001
Acidité tit	23,5	21	23,5	22,5	21	24	0,472
pH	6,67	6,5	6,8	6,75	6,5	6,9	0,305

†EST : extrait sec total MG : matière graisse MO : matière organique MM : minéraux ANP : azote non protéique ANC : azote non caséique MAT : matières azotées totales.

En effet, les teneurs moyennes du lait en MAT sont de 65,6 g/l et 64,0 g/l respectivement pour la SS et la CS, dont la teneur moyenne enregistrée durant notre période de l essai est de 64,8 g/l. Ce taux protéique est jugé acceptable et concorde avec ceux avancés par Atti et Rouissi (2003) et Rouissi *et al.* (2005). L analyse du taux caséique permet de nous informer sur le rendement fromager. La matière caséique enregistrée pour les deux races est de 51,6 g/l et 49,7 g/l respectivement pour la SS et la CS. La variation de la teneur du lait des deux races en caséines est représenté par la Fig. 2. L analyse de la variance a montré qu il y a une différence significative ($p < 0,05\%$) entre la matière caséique des deux races. Le lait de la brebis SS possède une teneur assez élevée en caséines renfor ant ainsi son aptitude la transformation fromagère.

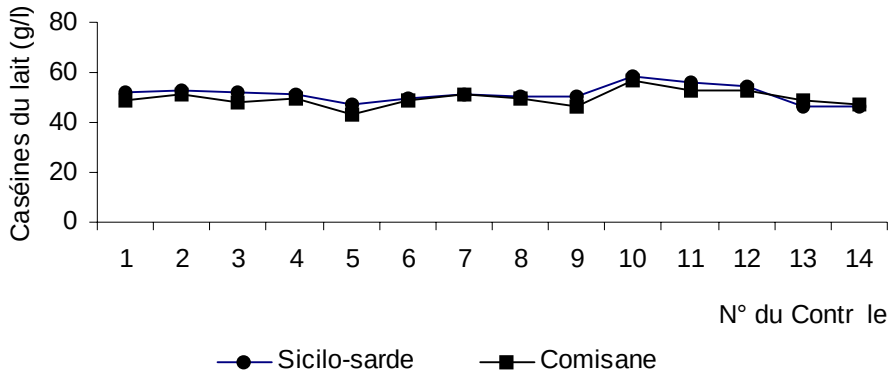

Fig. 2. Evolution des caséines du lait selon la race.

Conclusion

L étude comparative de la qualité du lait produit pour les deux races SS et CS ne montre pas de différences significatives pour la majorité des composantes physico-chimiques, cependant, on note une légère supériorité pour la SS concernant la teneur du lait en matière azoté totale. Les performances de production laitière montrent une supériorité de la CS, toutefois on n a pas encore extériorisé les potentialités productives des deux races. Pour augmenter la rentabilité des troupeaux ovins laitiers, il est impératif d améliorer les conditions alimentaires et d opter pour le sevrage précoce.

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Les jambons secs comme produits marqueurs de l'identité méditerranéenne. Une analyse croisée des conditions de leurs protections officielles en France et en Espagne

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RESUME – Le jambon sec se présente comme porteur d'une identité méditerranéenne. Pourtant, la protection des noms géographiques (AOP et IGP) est très variable selon les pays. Nous comparons les dispositifs et les pratiques de décision de deux pays contrastés : l'Espagne (où plusieurs AOP et IGP existent) et la France (où ne sont reconnues que peu d'IGP et aucune AOP). En Espagne, la zone d'élaboration du produit est un critère majeur alors que la zone de production des matières premières demeure faiblement définie. Les races locales et les systèmes d'alimentation sont traités différemment et un produit espagnol sous AOP (Teruel) est intéressant à analyser par rapport aux conditions d'un produit français sous IGP (Bayonne). Comment vont évoluer les projets d'AOP en cours d'instruction en France ?

Mots-clés : Jambons secs, protection, Espagne, France.

SUMMARY – "Dry cured jam as part of the Mediterranean identity. A cross-analysis of the situation of official protection in France and Spain". Dry cured ham is a part of Mediterranean identity. Nevertheless, among Southern European countries, big differencies concern the protection of geographical names (PDO and PGI regulation). We compare procedures and decision making about codes of practice in two contrasted countries: Spain (with several PDO and PGI already recognized) and France (with few PGI and no PDO recognized). In Spain, the processing area is a major criterion when the breeding area is less defined. Local breeds and rearing systems have diverse treatment and the conditions of a Spanish PDO product (Teruel) is interesting to analyse according to those of a French PGI one (Bayonne). What kind of decision should be made on some French PDO projects?

Keywords: Dry cured hams, protection, Spain, France.

Introduction

Le jambon sec constitue un produit phare de l'identité gastronomique des pays méditerranéens. Largement répandu dans cette zone, il peut être considéré comme un "marqueur" dans la mesure où un clivage net existe entre la zone de production de jambons sel sec (au Sud de l'Europe, dans les pays du bassin méditerranéen) et celle où la conservation des jambons frais passe par la salaison suivie d'un fumage (Nord et Centre de l'Europe). Dès lors, il semblerait logique de penser que les jambons sel sec, en tant qu'ensemble de produits véhiculant une partie de l'identité du bassin méditerranéen, ont constitué un support unanimement partagé d'initiatives de protection des dénominations géographiques (Appellations d'Origine Protégées – AOP, et Indications Géographiques Protégées – IGP). L'analyse de la réalité montre une situation beaucoup plus contrastée : si en Espagne et en Italie, certains produits de charcuterie sèche sont effectivement protégés sous forme d'AOP, au Portugal et en France cela reste rare et ce n'est pas le cas en Grèce.

L'objet de cette contribution est de proposer une analyse comparée des cahiers des charges de jambons secs dont les dénominations sont protégées ou inscrites dans une démarche visant à la protection dans deux pays dont les évolutions sont fortement contrastées : l'Espagne et la France. Elle a pour objectif de comparer les caractéristiques techniques du mode de production (depuis l'animal vif jusqu'au produit fini) et de proposer une analyse fine des modalités de prise en compte de ces spécifications par les institutions en charge de l'octroi de la protection.

Les dispositifs de protection des d nominations g ographi ues

En Espagne

Les protections existantes

Pays de longue tradition quant l utilisation de dénominations géographiques, l Espagne se dote en 1970 d une loi permettant de protéger les produits de la vigne par une Dénomination d Origine (DO). Le champ d application de cette loi est étendu en 1974 aux fromages, jambons et huiles d olive. Entre 1985 et 1988, plusieurs décrets complètent le dispositif en créant de nouveaux signes accessibles une vaste gamme de produits. Le décret du 8 juillet 1988 définit ainsi : (i) la DO qui protège "tout produit dont les qualités particulières sont dues au milieu géographique de production, la matière première utilisée et aux conditions de production et de transformation" et (ii) la "Denominación Especifica" (DE) protégeant "tout produit dont les qualités particulières sont dues une ou plusieurs des caractéristiques suivantes : lieu géographique de provenance du produit, race dont est issue la matière première, méthodes de production, de transformation et de vieillissement".

L introduction en 1992 du règlement 2081/92 définissant l AOP et l IGP est venue conforter la politique de qualité alimentaire espagnole. En effet, les définitions des deux formes de protection (DO et DE) sont très voisines de celles retenues pour les nouveaux signes européens. Un arrêté ministériel daté du 25 janvier 1994 est venu "officialiser" les correspondances : la Dénomination d Origine (DO) est l équivalent de l AOP européenne, la Dénomination Spécifique (DE) de l IGP.

Les autorités compétentes

Jusqu en 1984, l organisme compétent pour l attribution d une DO est l'Instituto Nacional de Denominacion de Origen (INDO), organisme public placé sous la tutelle du Ministère de l Agriculture, de la Pêche et de l Alimentation (MAPA) espagnol. Le Consejo Regulador de chaque DO est l instance déconcentrée qui exerce les prérogatives liées la protection, par délégation de compétence. Dans le cadre de la politique de décentralisation, les compétences du MAPA sont transférées partir de 1984 aux régions (ou Communautés Autonomes) qui deviennent les organes de tutelle des Consejos Reguladores des DO et DE. L INDO devient une sous-direction générale du MAPA et ses prérogatives sont restreintes : il est chargé de la ratification au niveau national des protections validées au niveau des régions[1] et de leur transmission Bruxelles en vue d un enregistrement en tant qu AOP ou IGP : le décret du 22 octobre 1999 est venu préciser les éléments que devaient fournir les régions l Etat espagnol en vue d une demande d enregistrement.

En France

Les protections existantes

Le régime national des dénominations géographiques s appuyait sur trois signes : l appellation d origine, les labels agricoles et la certification de conformité (CC), défini par la loi du 3 janvier 1994. Issue de la loi de 1905 sur la répression des fraudes, l Appellation d Origine (AO) suppose la délimitation d un "terroir" et l explication des usages "locaux, loyaux et constants" qui permettent l expression des aptitudes naturelles et confèrent au produit des caractéristiques originales et singulières (de Sainte-Marie et al., 2000). Par ailleurs, jusqu en 1994, les labels agricoles et la certification de conformité pouvaient faire usage de mentions géographiques.

La transcription du règlement 2081/92 traduit bien cette dichotomie : si elle n a pas posé de problème pour l AOP (dont la définition est très proche de l AO fran aise), elle s est avérée plus problématique pour l IGP qui n avait pas d équivalent en droit fran ais. La France a fait le choix de lier l usage d une IGP l obtention préalable d un label agricole ou d une CC. Cependant, la loi d orientation agricole votée fin 2005 rompt ce lien (cf infra) en maintenant toutefois l obligation de protection du nom par une IGP dès lors qu il est associé un signe national.

[1] Cependant, lorsque la zone de production d une dénomination géographique couvre plusieurs régions, c est l administration centrale qui possède les prérogatives normalement dévolues aux régions.

Les autorités compétentes

La reconnaissance d une AO est le fait de l Institut National des Appellations d Origine (INAO), organisme public paritaire entre l Etat et les interprofessions locales (ou Syndicats de Défense). L instruction du dossier se caractérise par une collaboration entre les demandeurs et les centres locaux de l INAO tant sur le fond que sur la forme. Si le Comité National de l INAO juge la demande justifiée, une Commission d enquête composée de professionnels extérieurs la filière concernée est nommée : elle se rend sur le terrain puis formule des recommandations quant aux conditions de production. Parallèlement, des experts extérieurs l INAO travaillent sur la définition de l aire de production. En cas de reconnaissance officielle de l AOC, sa gestion est déléguée une instance collégiale (Syndicat de Défense) représentative du système local qui agit par délégation de l INAO.

L homologation des Labels et des CC est le fait d une Commission Nationale des Labels et de la Certification (CNLC) au niveau national, chargée de la validation des référentiels dont le contr le est confié des organismes certificateurs accrédités selon la norme EN 45011. L apparition des IGP a entra né la création d une commission mixte paritaire CNLC – INAO qui statue sur les éléments du cahier des charges relatif au lien existant entre le produit et son origine géographique. Une nouvelle loi en 1999 a confié cette mission l INAO, ce qui a conduit créer un nouveau comité IGP au sein de l INAO. Le contr le des produits bénéficiant d une IGP est également confié l INAO qui le délègue des organismes certificateurs accrédités.

La Loi d Orientation Agricole votée fin 2005 remanie ce dispositif : la CNLC dispara tra compter de 2007 et l Institut National de la ualité et de l Origine (INAO) sera en charge des labels, des AO et des IGP. Ces dernières, désormais déconnectés des signes fran ais, seront bien contr lées par des organismes certificateurs accrédités selon le norme EN 45011. Les nouvelles modalités de contr le des AO sont en cours de discussion.

En conclusion, l analyse croisée des dispositifs en vigueur dans les 2 pays montre de fortes similitudes "culturelles" quant aux types de protection mais aussi quelques points de divergences : l Espagne propose un système apparemment plus homogène en ce qui concerne les modalités d instruction des demandes et de contr le (système unique pour les deux dénominations géographiques, DO et DE). Cependant, la forte décentralisation des compétences peut se traduire par une gestion opérationnelle différente selon les régions, tant en ce qui concerne l approbation des demandes que leurs modalités de contr le (ex : demande de fonctionnement des Consejos Reguladores conformes la norme EN 45011).

Analyse des demarches de protection des ambons secs

Après avoir présenté l état des lieux de la protection de jambons secs par des dénominations géographiques dans les deux pays, nous proposons une lecture croisée des cahiers des charges permettant de tirer quelques conclusions quant la "jurisprudence" des instances de reconnaissance.

Présentation de l existant

Espagne

L Espagne possède 5 jambons secs protégés par une dénomination géographique : 4 avec une AOP (Jamón de Teruel, Guijuelo, Dehesa de Extremadura, Jamón de Huelva), la cinquième (Jamón de Trevelez) est une DE qui a obtenu fin 2005 une IGP. Enfin, une sixième dénomination sous AOP est en cours d approbation par le MAPA (Jamón Los Pedroches).

uatre de ces protections (Guijuelo, Dehesa de Extremadura, Jamón de Huelva, Jamón Los Pedroches) utilisent une ressource génétique autochtone : la race ibérique (et son croisement avec la race Duroc). Les deux autres (Jamón de Teruel, Jamón de Trevelez) ont recours des génétiques plus conventionnelles (Large-White, Landrace, Duroc).

France

La France possède, depuis 1998, un jambon sec de la "zone méditerranéenne" enregistré en tant qu IGP (lié un certificat de conformité fran ais) : le Jambon de Bayonne. Aucun produit n est actuellement enregistré comme AOP (ni n a obtenu une AOC au niveau fran ais). uatre dossiers sont actuellement en cours d instruction par l INAO : trois d entre eux impliquent des ressources génétiques locales (Porc basque, Porc noir de Bigorre faisant appel la race gasconne, Charcuteries corses). Le dernier dossier Jambon de Lacaune s appuie sur des types génétiques conventionnels.

Analyse d ensemble des cahiers des charges espagnols

La lecture des cahiers des charges espagnols montre l importance donnée la phase de transformation de la matière première.

Ainsi, les zones d élaboration sont généralement définies selon leur caractère propice ou non au séchage naturel : sont ainsi indiquées, soit une liste positive de communes soit une condition d accès en relation avec une altitude (plus de 800 m, plus de 1000 m) qui sont mis en relation avec la présence d un air sec et froid. On ne retrouve pas, dans les cahiers des charges, de caractéristiques pédologiques ou hydrographiques qui serviraient justifier la délimitation des zones d élaboration. Par ailleurs, les caractéristiques finales du produit (y compris sensorielles) sont systématiquement décrites de fa on détaillée même si peu de valeurs cibles figurent l appui de ces objectifs.

A l inverse, la justification des zones de production de la matière première est quasi-absente des cahiers des charges. En ce qui concerne les DO de porc ibérique, les référentiels imposent la présence de "dehesa" qui peut être définie comme un écosystème entretenu par l activité de l homme qui combine la présence de chênes liège, de p turages et de systèmes de productions animales extensives. Cette définition reste peu précise : ainsi, la région Extremadure définit la dehesa par une loi datant de 1986, comme "toute exploitation de plus de 100 ha susceptible de permettre l exploitation de ressources animales en régime extensif". Elle conduit souvent les dénominations retenir des zones d élevage cheval sur plusieurs provinces voire régions. De plus, les DO de porcs ibériques recouvrent en fait plusieurs types de jambons chacun associés une exploitation plus ou moins importante – voire nulle – de la "dehesa" ("montanera", "recebo", "pienso" dans l ordre décroissant de cet usage).

Dès lors, deux questions se posent : sans nier l importance de l alimentation sur les caractéristiques organoleptiques de la viande fra che, la localisation de l élevage, dans les systèmes de type "pienso", est-elle indispensable la non reproductibilité (en un autre lieu) du produit ? Les conditions de production de l animal constituent-elles un élément déterminant de la différenciation des AOP ibériques entre elles ? L analyse des cahiers des charges que nous avons menée nous conduit penser que les autorités en charge de l instruction des dossiers au niveau des Communautés ont privilégié les éléments relatifs la phase de transformation dans leur analyse du lien au terroir et de la réputation du produit. u en est-il pour les produits espagnols plus proches des démarches entreprises en France ?

Une analyse croisée des dossiers Jambon de Lacaune / Jambon de Bayonne / Jamón de Teruel / Jamón de Trevelez

Nous analysons les démarches AOP et IGP impliquant des ressources génétiques conventionnelles dans les deux pays.

Le Jamón de Teruel est la plus ancienne des démarches : protégé au niveau national depuis 1984 (avec obtention d une AOP en 1997), ce produit représente lui seul, avec plus de 450 000 pièces commercialisées en 2004, environ 70% des jambons secs sous dénomination d origine. Soucieux de préserver la réputation d un bassin fort d un potentiel de production de 2 3 millions de jambons, les professionnels du secteur ont souhaité protéger le nom de ce produit et le différencier sur le marché, car ils étaient confrontés un usage largement galvaudé pour marquer des produits d origines diverses. Ils se sont tournés vers la DO, seul signe disponible en 1984 pour les jambons secs.

Comme pour les DO de porc ibérique, l accent est peu mis sur les liens entre les conditions de production du porc et les caractéristiques du territoire : ainsi, la zone de production est constituée de l ensemble de la province de Teruel (limites administratives). De plus, le cahier des charges n impose pas une provenance locale des matières premières servant l alimentation des porcs charcutiers.

Le Jamón de Trevelez (DE depuis 2004 et IGP depuis 2005) est un produit originaire du parc de la Sierra Nevada (province de Grenade). Elaborés dans des communes situées plus de 1 200 m d altitude, les jambons issus de porcs "blancs" sont affinés entre 17 et 24 mois.

Le contraste est ainsi marqué avec les deux démarches fran aises en cours :

(i) Les professionnels du bassin salaisonnier de Lacaune (Tarn) ont initié dès 1993 une démarche de protection du Jambon de Lacaune en demandant la reconnaissance comme AOC. Un important travail a été mené pour caractériser le produit fini et justifier le lien au terroir. Ainsi, le cahier des charges de production prévoit désormais, suite la demande des services de l INAO, l utilisation d une céréale qui était jadis et est encore aujourd hui produite dans la zone d élevage. 40% de l alimentation sera constituée de triticale ou de seigle dont la moitié devra être produite sur l exploitation et l autre moitié dans la zone d élevage (Rousseau et Sans, 2005)[2]. Suite l avis favorable donné le 24-11-2005 par le Comité National de l INAO, une délimitation effective et finale de l aire d appellation (zone de production du porc notamment) est en cours : elle mobilise des experts extérieurs la filière mandatés par l INAO.

(ii) Les producteurs et les salaisonniers du bassin de l Adour se sont mobilisés, l instar des producteurs du Jamón de Teruel, afin d éviter que le nom "Jambon de Bayonne" ne devienne générique (de Sainte-Marie et al., 2000). Dans un premier temps (1992), ils ont initié une démarche de reconnaissance en tant qu AOC mais n ayant pu "faire la preuve" de la non reproductibilité du système de production dans une autre zone, l INAO a refusé cette reconnaissance. Les professionnels se sont alors tournés vers l enregistrement en tant qu IGP (obtenue en 1998) couplée une certification de conformité. Devant la nécessité de rapatrier l élaboration des jambons dans un bassin d aire limitée (bassin de l Adour) sans mettre en péril les volumes commercialisés, le choix d une vaste zone d élevage, s appuyant sur les limites administratives de 22 départements du grand Sud-Ouest de la France, a été fait.

Ainsi, la situation du Jamón de Teruel, en ce qui concerne la localisation de la production de la matière première est paradoxalement mi-chemin entre les caractéristiques du Jamón de Trevelez (pour lequel aucune zone d élevage n est définie dans le cahier des charges) et les exigences fortes formulées en matière de justification du lien au terroir de l élevage de ces monogastriques pour les dossiers en cours d instruction en France.

Conclusions

L analyse croisée des contenus des référentiels et des dispositifs institutionnels montre des parentés entre les deux pays mais aussi des différences notables particulièrement quant la question de la justification du lien au terroir pour la partie élevage, dont les exigences semblent plus fortes en France. A ce titre, le résultat de l expertise menée actuellement pour délimiter l aire d élevage du "Jambon de Lacaune" devrait se révéler particulièrement instructif. Enfin, il est intéressant de suivre le devenir des autres dossiers de demande en France : auront-ils montrer un lien au terroir au-del de l usage des races "de terroir" ou bien le type "pienso" sera-t-il recevable ?

R f rences

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Molecular markers as guarantee of bovine meat traceability

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SUMMARY – The latest confidence crisis of consumers originated by the appearance of BSE have impelled the need to guarantee the origin of animals and their products. The objective of this work has been the establishment of a genetic traceability system using microsatellite DNA markers. Animals from two herds belonging to Parda de Montaña and Pirenaica cattle were monitored. A total of 674 samples have been analysed using the panel of microsatellites recommended by the International Society of Animal Genetics (ISAG) for identification studies. Different genetic parameters have been calculated and a program to verify the conventional traceability systems used has been designed. From a total of 111 meat samples obtained from slaughterhouse, it was possible to establish an objective link between an individual piece of meat, the animal and the farm in 102 cases, that is, 91.89%. From the remaining 8.11%, we found practically no links in 6 cases. Only in 2.7% of the total meat samples was it impossible to establish a correct link.

Keywords: Bovine, traceability, microsatellites.

RESUMÉ – *"Les marqueurs moléculaires comme garantie de la tra abilité de la viande bovine". Les dernières crises de confiance des consommateurs par l apparition de la maladie des vaches folles a entra né la nécessité de garantir l origine des animaux et de leurs produits. Un total de 674 échantillons appartenant à deux troupeaux (des races Parda de Monta a et Pirenaica) ont été analisés en utilisant des marqueurs des microsatellites recommandés par la Société Internationale de Génétique Animale (ISAG) pour des études d identification. Différents paramètres génétiques ont été calculés et un programme pour vérifier les systèmes conventionnels de tra abilité déjà utilisés a été désigné. D un total de 111 échantillons de viande obtenus à partir de l abattoir, il était possible d établir un lien objectif entre un morceau individuel de viande, l animal et la ferme dans 102 cas, équivalant à 91.89 . Seulement che 2,7 de tous les échantillons de viande des 8,11 restants il était impossible d établir le correct lien.*

Mots-clés : *Bovin, tra abilité, microsatellites.*

Introduction

Traceability of meat has become a very important aspect of food quality assurance for consumers and producers, mainly in the last years due to the precedent crises occurred in food industry as the major outbreak of BSE (Bovine Spongiform Encephalopathy).

Traceability in the context of food safety is defined in the European Regulation 178/2002 (EC, 2002) as the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporate into a food or feed, through all stages of production, processing and distribution. The application of traceability systems in the food chain has become obligatory since January 2005 (Neira, 2005).

Conventional traceability systems should ensure the animal origin of meat products, by means of ear tags, passports or labelling systems. Nevertheless this system could fail; the lost of document and the risk of cheating are real, that is why the need to develop techniques for verifying "a posteriori" the origin of meat (Loftus,2005).

The DNA identification technology offers a powerful means of authenticating and controlling these

conventional animal identification systems (Cunningham and Meghen, 2001) because the genetic information in each individual remains inalterable during its whole life, that is why this system displays an objectivity, repeatability and security not showed by other systems developed up to now.

The possibility to verify the animal products using scientist and objective methods increases the quality certification value (e.g. brands, PGI) allowing the development of some economic areas through the importance of typical products and given incentives for population conservation, keeping the biodiversity (Marsan *et al.,* 2004*).*

The aim of this work was to verify the traditional traceability system using microsatellites DNA markers in two herds from North Spain, and to develop an algorithm to compare DNA profiles that allows the establishment of a correct link between a meat sample, the animal and then the farm.

Material and methods

Samples

Animals from two herds belonging to Parda de Montaña and Pirenaica cattle were included in the study. Blood samples were obtained from every ancestor and descendant. In addition muscle pieces were sampled from offspring that went to slaughterhouse.

We got a total of 674 samples. Their accompanied data (identification number, sex, date of birth in case of offspring, data from parents in case of offspring, etc.) were entered in a database (Microsoft Access) to corroborate the origin of sample after genotyping.

DNA extraction

DNA was extracted from 100 µL of whole blood using the GF Genomic Blood DNA Purification Kit (Amersham Biosciences) and following the direct method described by the manufacturer. On the other hand, 200 mg of frozen meat sample were mixed with 1 ml of 1x RSB buffer pH 7.4 (10 mM Tris-HCl, 10 mM NaCl, 25 mM EDTA) and homogenized using a polytron homogenizer (OMNI GLH 220). Afterwards 40 µl SDS 20%, and 20 µl proteinase K 20 mg/ml were added and the mix was incubated at 50˚C for 3 hours. Standard protocols were used for DNA purification.

The quality and quantity of DNA were testing using a Gene uant pro RNA/DNA Calculator spectrophotometer.

Microsatellite markers and PCR

Nine microsatellites recommended by the International Society of Animal Genetics (ISAG) for animal identification were tested. Data of primers sequences and fluorescent label at 5 position, chromosomal location and range are listed on Table 1.

A single multiplex PCR reaction was designed to amplify the nine microsatellites. All 5 modified primers were combined to get fragments with variable length and labelling. The PCR reaction was achieved using 50 ng of genomic DNA, the appropriate amount of each primer pairs and the UIAGEN Multiplex PCR Kit 5x (UIAGEN) in a 6 l of final volume reaction. A thermocycler (2400 Applied Biosystems) was used under the following conditions: 1 cycle of 15 at 95 C 30 cycles as follows: 30" at 95 C, 1 at 58 C, 1 at 72 C, and a final extension of 30 at 72 C.

Electrophoresis was performed in an ABI PRISM 3130 Genetic Analyzer (Applied Biosystems) and the resulting profiles interpreted by GeneMapper v3.7 Software (Applied Biosystems).

Statistical Analysis

Allele and genotype frequencies were calculated using the Genepop v3.4 Software (Raymond and

Rousset, 1995) and exclusion probabilities were also determined. The match probability (MP) (Weir, 1996), which is defined as the probability of two animals sharing an identical allelic profile by chance, was determined in order to evaluate the power of microsatellite loci to discriminate among different individuals.

Table1. Microsatellites, PCR primer sequences and 5 fluorescent label, amplicon size and chromosomal location

Loci	Primer s sequences, and label at 5 in reverse primer	Range (pb)	Chromosome
ETH225 (D9S1)	GATCACCTTGCCACTATTTCCT **ED-** ACATGACAGCCAGCTGCTACT	140-158	9
INRA023 (D3S10)	GAGTAGAGCTACAAGATAAACTTC **ED-** TAACTACAGGGTGTTAGATGAACTC	196-222	3
ETH10 (D5S3)	GTTCAGGACTGGCCCTGCTAACA **ET-** CCTCCAGCCCACTTTCTCTTCTC	209-223	5
BM2113 (D2S26)	GCTGCCTTCTACCAAATACCC **ET-** CTTCCTGAGAGAAGCAACACC	125-143	2
BM1824 (D1S34)	GAGCAAGGTGTTTTTCCAATC **-FAM-** CATTCTCCAACTGCTTCCTTG	178-190	1
TGLA227 (D18S1)	CGAATTCCAAATCTGTTAATTTGCT **IC-** ACAGACAGAAACTCAATGAAAGCA	77-97	18
TGLA126 (D20S1)	CTAATTTAGAATGAGAGAGGCTTCT **-FAM-** TTGGTCTCTATTCTCTGAATATTCC	113-125	20
TGLA122 (D21S6)	CCCTCCTCCAGGTAAATCAGC **IC-** AATCACATGGCAAATAAGTACATAC	137-183	21
SPS115 (D15)	AAAGTGACACAACAGCTTCTCCAG **IC-** AACGAGTGTCCTAGTTTGGCTGTG	246-260	15

Application to traceability

An algorithm to compare DNA profiles was developed. It allows to establish the correct link between a meat sample, the animal and the farm. Moreover the algorithm allows to assign possible progenitors by searching in the DNA profiles database.

Population assignment of individuals

The power of the WHICHRUN v4.1 software (Banks and Eichert, 1999), a computer program for population assignment of individuals based on multilocus genotype data to allocate individuals to their most likely source population, was evaluated for the assignment of a muscle sample to their breed using the data from the herds analysed and from data obtained in our laboratory in other cattle populations (Casta, Betizu, Serrana Negra, Mallorquina, Menorquina, Monchina, Pirenaica and de Lidia)

Results and discussion

The 674 samples were genotyped for the nine microsatellites. The number of alleles varied between 4 for locus TGLA 126 and 12 for TGLA 122, results that are in accordance with those reported by V zquez *et al.* (2002) in "IGP carne de Asturias".

The probability of exclusion of microsatellite set was evaluated for all individuals in this study, showing that the panel of nine microsatellites is enough to get paternity exclusion upper than 99.9%. Excluding the TGLA 126 locus, which appears as the less polymorphic locus, we also obtain the

same results. So we could use an eight microsatellite panel for animal identification for routinely assays in traceability studies.

The probability of selecting two individuals by chance that share the same genotype in the 9 microsatellites was lower than 10^{-8}, even when related animals were included in the study (Table 2). Considering commercialization conditions, the probability of an existing fraud not being detected will be the probability of two DNA profiles matching by chance (V zquez *et al.*, 2004).

Table 2. Match probability in the different populations

Cattle population	Match probability (using nine microsatellites)
Parda	2.29123×10^{-9}
Pirenaica I	3.73857×10^{-8}
Pirenaica II	9.15626×10^{-9}
Pirenaicas I+II	8.24509×10^{-9}
Global	1.4419×10^{-9}

Application to traceability

The genotyping procedure allowed to reconstitute the two right blood-meat pairs. From a total of 111 meat samples obtained from slaughterhouse, it was possible to establish an objective link between an individual piece of meat, the animal and the farm in 102 cases, it means 91.89%. From the remaining 8.11%, we could found the causes of unlink in 6 cases. Then, only in a 2.7% of the total meat samples was impossible to establish a correct link. These results are summarized on Table 3.

Table 3. Possible causes of failures of matching

Meat sample (ID number)	Blood sample (ID number)	Result. Possible causes of failures of matching
5246 (I)	4842 (I)	No identical sample. No blood genotyped
5252 (II)	4847 (II)	No identical sample. Idem to blood sample 4857 (crossed samples), possible wrong labelled
5254 (III)	4857 (III)	No identical sample. Idem to blood sample 4847 (crossed samples), possible wrong labelled
5256 (IV)	4857 (IV)	No identical sample. Idem to 4872, maybe blood sample 4857 did not come and blood sample number 4872 came in the received tube, as they were received in the same date
5507 (V)	4932 (V)	No identical sample. Meat sample unknown origin, incompatible with father and mother, nevertheless the correspondent blood is compatible with the parents assigned in the database
5632 (VI)	5605 (VI)	No identical sample. Idem to 5574 received 0806 (the others blood and meat were received the same date, possible wrong labelled). Unknown origin
5767 (VII)	5195 (VII)	No identical sample. So many discordances. Unknown origin.
5774 (VIII)	5214 (VIII)	No identical sample. Idem to blood sample 5227 (crossed samples), possible wrong labelled
5781 (I)	5227 (I)	No identical sample. Idem to blood sample 5214 (crossed samples), possible wrong labelled

We could detect the possible practical causes of unlinked blood sample-meat in six from the nine cases. As we were working in a real live situation we could assume that this should be the percentage of error obtained routinely at slaughterhouse. So the percentage of error using traditional traceability

methods would be in the order of 8%. Using genetic methods we were able to minimize this value by detecting the causes of error/fraud as we have shown in Table 3.

Population assignment of individuals

From the total of 111 meat samples we could assign correctly 105 samples to Pirenaica or Parda breeds, corresponding to 94.58%. In the remaining 5.41%, we found that three of these cases were the same than those that we could not link with blood, meaning that only 2.705% of cases could not be assigned correctly.

We also tested the assignment probability to herd using each Pirenaica farm as a different population. In this case, from a total of 66 meat samples, we could not assign correctly 8 cases, it means 87.88% from which 4 unassigned samples belonged to the first Pirenaica farm and the other 4 to the second. These results could be logical as we are working with the same breed, so the allelic frequencies are too similar.

Using the data obtained from others breeds (including a different Pirenaica population), we found that the 90.91% of meat samples were correctly assigned to Pirenaica breed and the remaining 9.09% was assign almost always to Serrana Negra breed, a population that could have been mixed with Pirenaica.

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Sensory evaluation of lamb produced under different production systems from Uruguay and Europe

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SUMMARY – Some geographical areas in South America have a very high potential in ruminant meat production (i.e., Humid Pampas). This meat, produced at low cost under grazing conditions, has an undoubted growing potential and represents one of the main exports from those countries to USA and Europe. The aim of this study was to compare, with a trained taste panel, Uruguayan lamb aged for 20 days (11.1 and 19.4 kg carcass weight being 3-4 and 12-13 months old, respectively) with European lambs, aged for 7 or 20 days. European lambs were produced in Spain (10.2 kg carcass weight and 3 months of age), United Kingdom (22.8 kg from commercial animals) and Germany (23.2 kg and 4-6 months old). Results showed that lamb type had a significant effect in all the parameters considered, except in lamb flavour intensity, and that ageing had a strong influence in lamb sensory profile. The key factors related to the differences found in the sensory evaluation between lamb meats are highlighted.

Key words: Meat quality, concentrate, grass, panel test.

R SUM **–** "Evaluation sensorielle d'agneaux produits sous différents systèmes de production d'Uruguay et d'Europe". Plusieurs régions d'Amérique du Sud présentent un potentiel très élevé pour la production de viande de ruminants. Cette viande est produite assez économiquement en conditions de pâturage (Pampa), elle a une qualité indiscutable et elle est un des produits les plus exportés vers les USA et l'Europe. L'objectif de cet article est donc de comparer par un panel sensoriel la viande de l'Uruguay maturée pendant 20 jours (11,1 et 19,4 kg de carcasse et 3-4 et 12-13 mois d'âge, respectivement) à des moutons de l´Europe : Espagne (10,2 kg carcasse et 3 mois d'âge), Royaume-Uni (22,8 kg pour des animaux commerciaux) et Allemagne (23,2 kg et 4-6 mois). Les études réalisées montrent que l'effet du type de mouton est significatif pour tous les paramètres étudiés, à l'exception de l'intensité de la flaveur, et que la maturation de la viande est très importante pour les caractéristiques du produit. Les facteurs relatifs aux résultats trouvés lors de l'évaluation sensorielle sont aussi discutés.

Mo s s : Qualité de la viande, concentré, pâturage, panel sensoriel.

Introduction

World lamb consumption is around 2 kg per capita with large variations between continents (17 kg in Oceania or 0.7 kg in North America) or even between countries or regions inside the same country. With 1.1 million tm in 1996, the international trade of sheep represents a small percentage of all the international meat trade. However, among all the meats, sheep meat remains the most internationally traded (15% of total world production is exported), which explains the potential existence of different lamb products in the same market.

In this sense, sheep production systems vary considerably across the world, and reflect the different local environmental conditions, which determine, to a large extent, breeds, housing, levels of intensification and, at the end, local market requirements. Pastoral systems are especially important in some areas of South America (i.e., Humid Pampas) where high amounts of grass grow naturally at

low cost and grazing is the obvious productive system orientation. Meat production in these regions, such as in Uruguay, is one of the most important exports to USA and Europe.

To those countries with these natural privileged grazing regions, that have a well-developed meat chain, it is a very important and positive competitive advantage to know the preferences and acceptability of their products in foreign markets. In Europe, there is a large variability in lamb production and subsequently in the culinary background of its citizens. In any case, this variability makes, a priori, a clear difference between North and Mediterranean countries, and even between consumers that has high or low lamb consumption levels. Thus, Mediterranean regions apparently have pale and delicately flavoured flesh, in contrast to the larger, fatter and more robustly flavoured types produced in northerly areas. Also, countries such as Spain or UK have relatively high lamb consumption whereas others, such as Germany, have very low rates. Historically, it has been shown that in areas with low meat consumption, sheep meat is generally disliked because its strong flavour and odour. However, in areas where people consume a large amount of sheep meat, apparently flavour is more enjoyed (Griffin *et al*., 1992).

That variability in tastes represents market opportunities to change or to diversify the offer. Nevertheless, in any case, it is not completely clear which type of lamb products respond to the demand.

In a previous work, with Uruguayan and European lamb meat, consumer tended to prefer known or local meat (Font i Furnols *et al*., 2006). But, up to date, nothing has been scientifically published based on the results of trained panels that could generate interesting meat sensory profiles and large comparative results between grass fed animals from South America and those produced in some European conditions. In this sense, there are some experimental sensory studies comparing animals produced inside Europe, (Sañudo *et al*., 1998), USA (Griffin *et al*., 1992) or Canada (Jeremiah, 1988). But in these studies, the lamb variability analysed was not too large having the animals similar carcass weight and rearing system, which imply, a priori, low variability in their sensory properties (Carluzzi *et al*., 1999 Arsenos *et al*., 2002 Priolo *et al*., 2002). The purpose of the present paper was to assess the sensory characteristics of grass-fed animals from Uruguay in comparison with local European products.

Material and methods

Animals

Twenty light (11.1 1.4 kg cold carcass weight, 3-4 months old) and twenty heavy (19.4 2.2 kg cold carcass weight, 12-13 months old) Uruguayan castrated male lamb from Corriedale breed were selected. Lambs were reared in an improved grass fed system. Sixty more commercial lambs were chosen in Germany (DE), Spain (ES) and United Kingdom (UK), being 20 in each country.

In Germany, lambs (23.2 3.6 kg cold carcass weight) had 4-6 months of age, they were males from crossbreeds between Suffolk or Schwarzk pfiges Fleischschaf x Merino Landschaf breeds. Animals were finished on pasture (clover mainly) supplemented with wheat, bean and pea concentrate.

In Spain, lambs (10.2 0.6 kg cold carcass weight, 3 months old) were males from Rasa Aragonesa meat breed. They were reared intensively and fattened indoors with concentrate and cereal straw *ad libitum*.

In United Kingdom, animals (22.8 1.7 kg cold carcass weight) were commercial castrated from different commercial crosses. British lambs were reared extensively on pasture and supplemented only at specific times.

Sampling

Lambs from the four countries were slaughtered in commercial EU licensed abattoirs using standard procedures.

Carcasses (Table 1) were kept entire at 2°C for 48 hours after slaughtering. Then, loins were deboned and the *Longissimus thoracis* muscle, left side (T6 – T13) was cut for the sensory panel study. They were vacuum packaged in aluminium bags and kept at 2°C until the end of the ageing period (20 days for both Uruguayan types and 7 and 20 days for all the European lambs). After that, they were frozen at -20°C until the day before running the panel test. Twenty days represent the time that the Uruguayan meat would take to reach the European Market and seven days is an approximate local ageing time for European meat.

Table 1. Main carcass characteristics (means) of the different types of lambs used in this experiment

	Cold carcass weight (kg)	Conformation score†	Fatness score††
Light Uruguayan lambs	11.1	2.5 (O+)	2.3
Heavy Uruguayan lambs	19.4	2.8 (R)	2.9
German lambs	23.2	2.6 (R-)	2.8
Spanish lambs	10.2	1.0 (P)	1.8
British lambs	22.8	3.6 (U-)	3.0

†EUROP (Lamb Carcass Classification System).
††1-5 scale.

Sample preparation and panel test design

An eight-member Spanish trained sensory panel was used to evaluate the samples using a quantitative descriptive analysis. Assessors were trained (ISO 8586-1:1993) in sensory profiling for lamb meat.

After thawing in tap water until reaching an internal temperature of 16-18°C, lamb samples were cut (Fig. 1) into four 2 cm-thick slices and cooked on a pre-heated double hot-plate grill at 200°C until the internal temperature reached (70°C). Samples were wrapped in aluminium foil and identified with a single random three-digit code they were kept warm until serving (10-15 minutes after cooking).

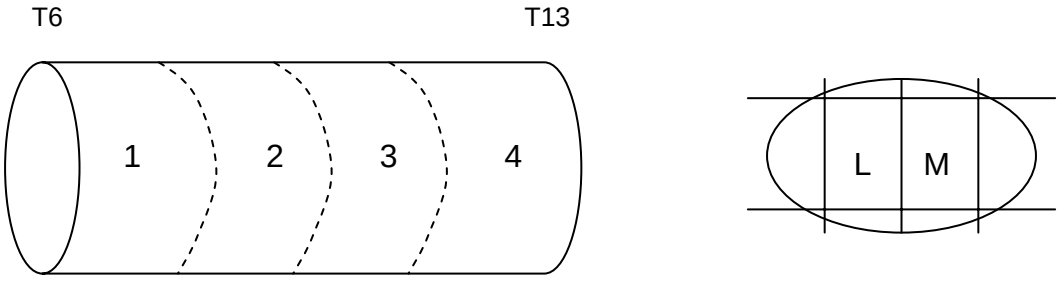

Fig. 1. Slices distribution along *Longissimus thoracis* (1-4) and inside for each chop offered to each panel member (L, lateral - M, medial).

Sensory tests were performed in 14 sessions in a controlled sensory analysis laboratory (ISO 8589:1988) with individual booths and red light, to mask any differences in meat colour. In each session, panellist received three sets (plates) of four samples. The plates were prepared following the experimental designs proposed by Cochran and Cox (1978). Samples represented four of the eight experimental treatments (2 lamb types of Uruguay and three lamb types at two ageing types in each European country). Meat was served following a balanced design to avoid the effect of the first sample and carry over effect. Panellists were asked to eat a bit of bread and to drink a bit of still water at the beginning of the sensory evaluation and between samples to try to make the palate conditions similar for each sample.

Panellist evaluated the meat samples following an eight-point scale. Lamb odour intensity, off-odour intensity, tenderness, juiciness, lamb flavour intensity, fatty flavour intensity, off-flavour intensity, flavour quality and overall acceptability. Scores ranged between 1 (no odour, very tough, very dry, no flavour and unpleasant) and 8 (very intense odour, very tender, very juicy, very intense flavour and very pleasant).

Statistical analysis

One hundred and sixty judgements were obtained per treatment (as a result of the combination of lamb type and ageing time). Data were analysed using GLM procedure of SAS (1999). Panellist, plate (within session) and treatment were considered as fixed effects also panellist by treatment interaction was introduced into the model. The Tukey multiple range test was used to show significant differences among means. Differences were considered significant at the $P < 0.05$ level. A Procrustes transformation, that corrects differences in the use of the scale between panellist, was performed previously to a principal component analysis (PCA).

Results and discussion

Significance of the effects considered is shown in Table 2. Panellist was a significant factor for all the sensory attributes ($P < 0.001$), which is quite common in sensory studies due to the different uses of scale (Rousset-Akrim *et al*., 1997). Also, plate (within session) was significant, which is normal because not the same treatments were tasted in the same plates. A significant interaction between treatment and panellist was found for the odour, flavour and hedonic attributes, but it was ordinary and little important.

Table 2. Significance for the sensory descriptors evaluated in the *Longissimus thoracis* of lamb, according to the studied factors

	Lamb odour intensity	Off odour intensity	Tenderness	Juiciness	Lamb flavour intensity	Fatty flavour intensity	Off flavour intensity	Flavour quality	Overall acceptability
Treatment	+	***	***	+	NS	**	***	***	***
Panellist	***	***	***	***	***	***	***	***	***
Plate (session)	***	*	***	***	***	***	***	***	***
Root MSE	1.24	1.63	1.24	1.53	1.15	1.35	1.87	1.35	1.41

$^{+}P < 0.10$ *$P < 0.05$ **$P < 0.01$ ***$P < 0.001$ NS = not significance.

Treatment was almost significant in all the variables studied, except in lamb flavour intensity. Higher significance was observed for off flavours and odours, tenderness and hedonic variables than for fatty flavour intensity and, specially, lamb odour intensity and juiciness. The same tendency, higher F-values for tenderness, comparatively with juiciness, and for flavour respect to odour, was found by Mart nez-Cerezo *et al*. (2005) when breed, slaughter weight and ageing time effects were analysed.

In Table 3, it can be observed that the highest "lamb odour intensity" was found in the Spanish lamb aged by 7 days, probably because the Spanish panel is more used to this type of lamb and ageing time. However, it was only statistically different from the Uruguayan light lamb. Between both Uruguayan types there were not significant differences due to slaughter weight and age, which agrees with Carluzzi *et al*. (1999), showing that in animals castrated and reared in similar way, age differences higher than 8-9 months are not important in lamb odour.

The highest "off odour intensity" notes were associated with longer ageing times, in animals fed with concentrates. Ageing tends to modify odour according to proteolysis and oxidative processes. Obviously, animals produced in extensive systems support better ageing than younger, especially

those from Spain or Germany, probably because of differences in muscular structure and physiology as well as of the higher content of antioxidant compounds in grass.

Table 3. Sensory profile of different types of lamb† from Uruguay or Europe aged by 7 or 20 days

	Lamb odour intensity	Off odour intensity	Tenderness	Juiciness	Lamb flavour intensity	Fatty flavour intensity	Off flavour intensity	Flavour quality	Overall acceptability
UY light	4.51 b	2.80 c	6.96 bc	4.94 ab	5.91	4.55 ab	4.29 cd	4.08 ab	3.94 ab
UY heavy	4.71 ab	3.02 c	7.23 b	5.19 a	5.80	4.74 ab	4.78 b	3.96 b	3.87 b
ES 7 days	5.03 a	3.12 c	7.38 a	5.07 ab	6.11	4.83 a	4.76 b	3.87 b	3.78 b
ES 20 days	4.87 ab	3.35 a	7.73 a	4.89 ab	5.95	4.57 ab	5.58 a	3.25 c	3.14 c
DE 7 days	4.82 ab	2.59 c	6.53 c	4.64 b	5.83	4.28 b	3.69 d	4.62 a	4.43 a
DE 20 days	4.84 ab	3.35 a	7.31 a	4.82 ab	6.01	4.47 ab	3.90 cd	4.41 ab	4.29 ab
UK 7 days	4.77 ab	2.74 c	6.65 c	4.81 ab	5.76	4.29 ab	4.39 cd	4.25 ab	4.06 ab
UK 20 days	4.80 ab	3.13 b	7.15 b	4.96 ab	5.75	4.43 ab	4.55 bc	4.09 ab	3.97 ab

†UY = Uruguay ES = Spain DE = Germany UK = United Kingdom.
[a,b,c]Different letters significant differences between treatments ($P < 0.05$).

The highest "tenderness" scores were found in lamb aged for 20 days, and from young animals reared intensively (3 months old). Within Uruguayan meat, comparing animals of 3-4 *vs* 12-13 months old, there was not significant differences, showing the importance of ageing in lamb texture and that age, considering long ageing periods, is less important than what it could be expected (Santos-Silva *et al*., 2002 Sañudo *et al*., 2003). The lowest tenderness was found in older animals aged for 7 days, showing the importance of ageing in meat textural characteristics.

Given its higher intramuscular fat content (D az *et al*., 2006), heavy Uruguayan lambs have shown the highest "juiciness" since high levels of fat could make meat more tender and juicy (Mart nez-Cerezo *et al*., 2005). Only significant differences were found with German meat aged for 7 days.

"Lamb flavour intensity" was not statistically different between lamb types, showing, as in odour, some identification of lamb perception with that at which the panel was more confident. It could be expected that odour and flavour intensity were scored higher in older and grass feed animals as found by Sañudo *et al*. (1998) when British and Spanish typical lambs were tasted.

On the other hand, "fatty flavour intensity" was higher in the Spanish and Uruguayan animals, although the only significant difference was found between the Spanish and the German lambs, both aged for 7 days. The more unsaturated fat in the Spanish lambs, with lower melting temperatures, and the highest fat content of the Uruguayan heavy lambs (D az *et al*., 2006) could justify the results.

Within each country, the highest "off flavour" rates were detected, as expected, in meat aged for longer times. It could also be observed that, in general, flavour differences were higher than those found in odour. These results are in agreement with Mart nez-Cerezo *et al*. (2005) and Rousset-Akrim *et al*. (1997). These latest authors indicated that proteolysis products (peptides), which are some of the many compounds involved in off flavour, are largely increased from 7 days onwards. Also, for Uruguayan lambs, heavier animals had higher off flavour notes.

Given the presence of off flavours and fatty flavours, which have low acceptability, the lowest scores for "flavour quality" and "overall acceptability" were found for the Uruguayan heavy animals and the locals, especially if the meat was aged for 20 days. The same meat was also penalised by the Spanish consumers in the same animals (Font i Furnols *et al*., 2006). Also, Mart nez-Cerezo *et al*. (2005) found that Rasa Aragonesa lambs had slightly lower flavour quality associated with their highest fat and off flavour intensities. Besides, it is known that flavour is one of the main characteristics in determining acceptability in lamb (Corcoran *et al*., 1999).

In Fig. 2 can be observed how the different treatments and attributes are grouped according to the PCA. Axis one explains 74.48% and axis two 12.97% of the total variability. Thus, the panel separated by the axis 2 (vertical) the younger and more intensively fed animals (Spanish and

Germans) from the older and more extensively fed lambs (Uruguayan and British). This axis was also associated to lamb odour and flavour and juiciness, probably the most important attributes to discriminate these types of animals coming from different production systems (Sañudo *et al*., 1998). The horizontal axis-1, associated with overall acceptability, tenderness and off and fatty flavours discriminated German, especially aged for 7 days, and Spanish lambs, specially those aged for 20 days. Animals reared mainly with grass remained in an intermediate position.

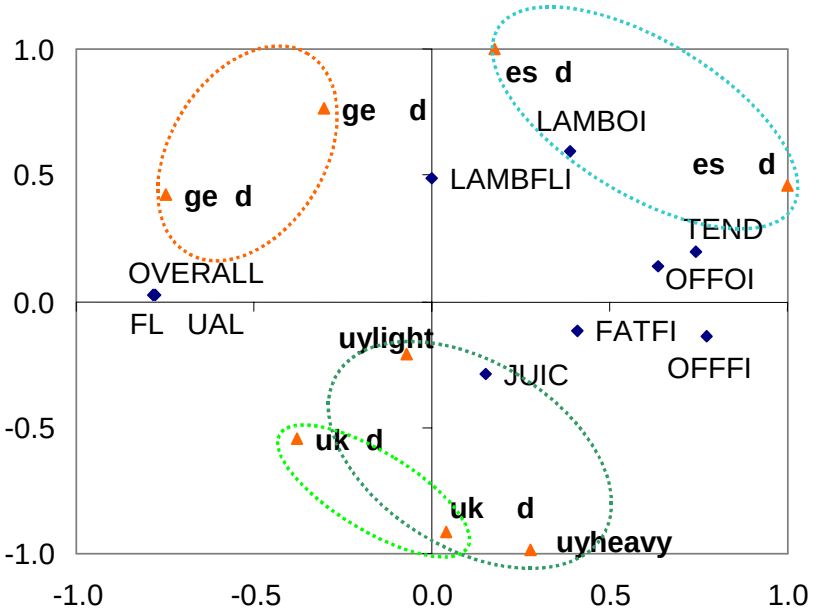

Fig. 2. PCA between sensory traits and lamb types (treatments). Ge: German es: Spanish uk: British 7 and 20 d: meat aged by 7 or 20 days uylight: Uruguayan light lambs uyheavy: Uruguayan heavy lambs. LAMBOI: lamb odour intensity OFFOI: off odour intensity LAMBFLI: lamb flavour intensity TEND: tenderness JUIC: juiciness OVERALL: overall acceptability FL UAL: flavour quality FATFI: fatty flavour intensity and FLE TR: off flavour intensity.

Conclusions

Sensory meat quality is significantly influenced by lamb type – production system and ageing time. These two effects produce a large variability in lamb quality, which could cover consumer demands across Europe. This is particularly important in this continent, given its large variability in consumption and culinary background in lamb products.

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Production de veaux rosés Salers : Effets du type de fourrage et du niveau de concentr sur les caract risti ues de la carcasse et la ualit de la viande

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RESUME – Ce travail essaie d étudier la possibilité de production de veaux sous la mère finis vers 10 mois en utilisant la race Salers et l effet de l alimentation (type de fourrage et niveau de concentré) sur les caractéristiques de la carcasse (poids, composition tissulaire, conformation, engraissement) et la viande (pH, activité des enzymes musculaires, surface des fibres musculaires, caractéristiques sensorielles) obtenues. Le dispositif expérimental comprend 20 veaux Salers répartis l ge de 150 jours en 5 lots selon l alimentation re ue jusqu l abattage (10 mois, non sevrés) : FH (foin-haut concentré), FB (foin-bas concentré), HH (herbe coupée-haut concentré), HB (herbe coupée-bas concentré) et TP (témoin p turage-haut concentré).

Mots-cl s : Veaux sous la mère, type de fourrage, niveau de concentré, carcasse, qualité de la viande.

SUMMARY – *"Saler pink veal production: Effects of forage type and concentrate level on carcass characteristics and meat quality". his ork studies the effect of forage type and concentrate level on carcass characteristics (eight, composition, conformation, fatness) and meat quality (p , muscle en yme activities, muscle fibre area, lipid content, sensorial characteristics) of young suckling Salers bulls. enty Saler male calves of 1 0 days of age ere assigned to groups differing in feeding received until slaughter, F (hay high concentrate), FB (hay lo concentrate), (cut grass high concentrate), B (cut grass lo concentrate) and P (pasture high concentrate) and slaughtered at 10 months of age.*

Keywords: *Un eaned bulls, forage type, concentrate level, carcass, meat quality.*

Introduction

La finition d une partie des broutards en veaux "rosés" partir des troupeaux allaitants peut être une source de diversification pour ce type d élevage. Elle semble spécialement intéressante dans les zones fortes contraintes, comme la montagne. Les "veaux rosés" sont des animaux voisins des broutards allaitants (majoritairement vendus en maigre pour l engraissement), élevés et engraissés sous la mère et abattus 9-11 mois environ. Cependant les itinéraires de production (ge d abattage, niveau de concentré de la ration, utilisation de d herbe ou de fourrages conservés) et les effets de ces itinéraires sur la qualité des carcasses et la qualité organoleptique de la viande, restent définir.

Cette expérimentation porte sur l effet de l alimentation (type de fourrage et niveau de concentré) apportée au veau sur les caractéristiques des carcasses et des viandes vers 10 mois d ge.

Mat riels et m thodes

Le dispositif expérimental comprend 20 veaux Salers, nés en moyenne le 2 janvier, alimentés au lait sous la mère jusqu 4,5 mois d ge, puis répartis la mise l herbe mi-mai en 5 lots.

Dans les traitements FB (foin - bas concentré), FH (foin - haut concentré), HB (herbe - bas concentré) et HH (herbe -haut concentré) les veaux (n = 4 par lot), logés dans des cases individuelles, re oivent des rations base de foin de dactyle ou herbe verte coupée, deux niveaux d aliments concentrés (*ad libitum* ou moitié de cette quantité) et boivent le lait de leur mère (tétée 2 fois par jour). Les vaches des lots FB et FH re oivent également un foin de dactyle et les vaches des lots HB et HH p turent de l herbe verte l extérieur.

Dans le traitement TP (Témoin p turage) les veaux restent au p turage en altitude avec leurs mères et ont accès un distributeur de concentré *ad libitum*.

Les veaux sont abattus 10 mois d ge. Les mesures portent sur : (i) le niveau d ingestion individuel des différents aliments (mesure 5 jours par semaine pour les fourrages et le concentré, lots FB, FH, HB et HH et 1 fois par semaine pour le lait bu) et l évolution du poids vif (pesée 1 fois par semaine) (ii) le poids final, l état d engraissement (classification de 0 5) et la conformation (classification EUROP, échelle de 0 15) des carcasses et le poids des différentes tissus de la carcasse (iii) le pH mesurée 24 heures après l abattage sur le muscle *Rectus abdominis* (RA) (iv) l étude de la taille de fibres par histochimie (v) l étude du type métabolique des muscles RA et *Semitendinosus* (ST), trois enzymes ont été utilisées pour comparer le métabolisme oxydative, l isocitrate déshydrogénase (ICDH), la cytocrome oxidase (CO) et la citrate synthase (CS), et deux pour le glycolytique, la lactate déshydrogénase (LDH) et la phosphofructokinase (PFK) (vi) l étude de la composition du muscle en collagène (collagène total et insoluble du muscle RA) (vii) l étude de la teneur en lipides du muscle RA et (viii) les qualités organoleptiques de la viande (muscle *Longissimus thoracis* : LT) appréciées par un jury entra né.

Les différentes variables ont été traitées par analyse de variance en utilisant la procédure GLM (SAS, 1989) pour comparer les différents lots et pour mettre en évidence les effets du type de fourrage et du niveau de concentré selon un schéma factoriel (2x2).

R sultats et discussion

L ingestion moyenne journalière de lait (Tableau 1) sur la période expérimentale (151 14 j, de la mise l herbe l abattage) des 4 lots n est pas différente. L ingestion de concentrés des lots maintenus ad libitum augmente de 0,5 kg 5,5 kg/jour, approximativement, et elle est, comme prévu, presque le double de la consommation des lots FB et HB. L ingestion moyenne journalière de fourrage des lots bas niveau de concentré est, d environ, 1,8 fois supérieure celle des lots haut niveau de concentré. L ingestion totale de concentrés du lot TP est, en moyenne, de 377 kg, soit 17 et 23 % plus élevée que celle des lots FH (455 24 kg) et HH (488 37 kg). Par contre, les valeurs moyennes d ingestion de lait totale ou journalière (942 146 kg et 5,86 0,73 kg/jour) sont plus élevées, mais non significativement différentes des valeurs des autres lots.

Le poids initial (la mise l herbe, 141 j 9 d ge) atteint en moyenne 166 kg 9. L ge l abattage n est pas différent entre les lots (291 j 6). Seul le niveau de concentré affecte la vitesse de croissance (GM) (1248 *vs* 1354 g/j respectivement, P = 0,09) (Tableau 2). Le niveau de concentré affecte significativement le poids vif vide (PVV) (P = 0,05) et le poids de carcasse (P = 0,07). Les animaux du lot HH ont des PVV et des poids de carcasse les plus élevés (+ 15 kg) suivis des lots FH, HB et FB, ces différences entre lots sont significatives (P<0,1) seulement sur le PVV des lots HH et FB. Le GM du lot TP (1542 g/jour) est plus élevé que celui des autres lots (P<0,05). Ce lot a aussi les valeurs les plus élevées de PVV et de poids de carcasse mais ces différences entre lots sont significatives seulement sur le PVV et le poids de carcasse du lot TP avec le PVV du lot FB (P<0,05) et le poids de carcasse des lots FB et HB (P<0.1). Le niveau de concentré affecte le poids des muscles de la carcasse (P<0,05) (les lots HH et TP présentent valeurs plus élevés que les lots FB et HB). Le poids des tissus adipeux, les notes d engraissement et de conformation des carcasses ne sont pas significativement différentes pour des comparaisons réalisées (P 0,1).

Les différences observées au niveau de la GM entre les lots haut et bas niveau de concentré se traduisent en différences du poids de carcasse liées un poids de muscles plus élevé mais sans effet sur l état d engraissement. Normalement les vitesses de croissance élevées sont associées des carcasses plus grasses, mais très souvent les expériences sur ce type de résultats ont été réalisées avec des animaux plus gés et/ou de sexe différent (Listrat et *al.*, 1999 Sami et *al.,* 2004) que ceux de cette étude. En accord avec nos résultats, Sinclair *et al.* (1998) obtiennent des différences sur le poids de carcasse mais pas sur l engraissement chez des taurillons Charolais abattus entre 10 et 19 mois et ayant eu des différences de vitesse de croissance d environ 600 g/jour.

Tableau 1. Ingestion volontaire d'aliments

	FB	FH	HB	HH	s.e.	Type de fourrage	Niveau de concentré
Ingestion de lait (kg/j)	5,17	5,17	5,23	5,02	0,580	0,94	0,85
Ingestion de concentré (kg MS/j)	1,73^{b}	3,18^{a}	1,71^{b}	3,26^{a}	0,060	0,62	0,0001
Ingestion de fourrage (kg MS/j)	2,26^{a}	1,41^{b}	2,55^{a}	1,24^{b}	0,298	0,84	0,003

a, b : Les moyennes d'une même ligne avec ces suffixes différent significativement (P<0,05).

Tableau 2. Gain de poids vif, caractéristiques d'abattage et des carcasses, effet du type de fourrage (F) et du niveau de concentrés (C)

	Comparaison entre les 5 lots									Comparaison fourrage-concentré		
	FB	FH	HB	HH	TP	s.e.	Lot	Poids initial	s.e.	F	C	Poids initial
Gain de poids vif moyen (g/j)	1232^{b}	1340^{b}	1264^{b}	1368^{b}	1542^{a}	55	0,01	0,02	56	0,60	0,09	0,08
Poids vif vide (kg)	307,9^{b}	331,1^{ab}	312,2^{ab}	334,0^{a}	347,8^{a}	10,9	0,10	0,06	9,9	0,73	0,05	0,09
Poids de carcasse (kg)	197,8^{d}	211,7^{cd}	200,2^{d}	215,6^{cd}	230,4^{c}	7,9	0,07	0,06	7,1	0,67	0,07	0,14
Muscles de la carcasse (kg)	140,8^{b}	151,7^{ab}	141,6^{b}	154,5^{a}	164,8^{a}	5,9	0,07	0,11	5,1	0,74	0,04	0,28
Dépôts adipeux de la carcasse (kg)	21,7	22,7	23,2	24,0	24,0	1,2	0,15	0,07	1,2	0,25	0,45	0,04
Etat d'engraissement (0-5)	2,23	2,13	2,25	2,13	2,12	0,16	0,95	0,92	0,12	0,96	0,55	0,66
Conformation (EUROP)	5,57	5,57	5,76	6,85	7,16	0,54	0,16	0,03	0,50	0,22	0,36	0,11

a, b et c, d : Les moyennes d'une même ligne avec ces suffixes différent significativement, P<0,05 et P<0,01 respectivement.

Tableau 3. Surface des fibres et activité de la lactate dehydrogenase (LDH), phosphofructokinase (PFK), isocitrate dehydrogenase (ICDH), citrate synthase (CS) et cytochrome-c oxidase (COX) et effet du type de fourrage (F) et du niveau de concentré (C) pour les muscles *Rectus abdominis* et *Semitendinosus* et teneur en acides gras pour le muscle *Rectus abdominis*

	Comparaison des 5 lots					s.e.	Lot	s.e.	Comparaison fourrage-concentré		
	FB	FH	HB	HH	TP				F	C	FxC
Recturs abdominis											
Surface des fibres (μm^2)	2168	2541	2149	2203	2240	233	0,75	252	0,49	0,41	
LDH (µmol/min par g)	841,2	883,7	811,2	908,1	866,6	50,8	0,71	52,4	0,96	0,21	
PFK	123,9	105,6	115,2	124,1	96,6	9,5	0,23	8,8	0,55	0,57	
ICDH (µmol/min par g)	1,32	1,52	1,41	1,24	1,54	0,13	0,45	0,12	0,48	0,93	
CS (µmol/min par g)	4,40	6,04	5,92	4,96	5,86	0,56	0,21	0,51	0,67	0,52	0,03
COX (µmol cyt c par min par g)	14,38	15,73	13,54	11,70	17,57	2,24	0,45	2,0	0,25	0,90	
AG totaux (mg/g MS)	74,6	63,5	70,0	66,5	63,0	7,2	0,77	7,9	0,92	0,38	
Semitendinosus											
Surface des fibres (μm^2)	2569^{ab}	2333^{b}	2147^{b}	2615^{ab}	3163^{a}	253	0,10	277	0,80	0,76	
LDH (µmol/min par g)	895,4	843,0	900,2	913,2	867,7	60,2	0,92	62,0	0,56	0,68	
PFK	137,8	129,7	126,5	126,2	117,1	9,4	0,65	9,9	0,47	0,70	
ICDH (µmol/min par g)	1,90	2,33	1,51	1,76	1,91	0,60	0,91	0,65	0,48	0,61	
CS (µmol/min par g)	$6,40^{ab}$	$5,30^{b}$	$4,52^{b}$	$6,67^{ab}$	$8,10^{a}$	0,81	0,06	0,90	0,78	0,57	0,09
COX (µmol cyt c par min par g)	11,76	16,23	12,70	16,23	14,60	2,24	0,53	2,47	0,85	0,13	

a,b : Les moyennes d'une même ligne avec ces suffixes différent significativement ($p<0,05$) ; AG : acides gras.

Les valeurs de pH (5,78 5,76 5,87 5,74 5,72 pour les lots FB, FH, HB, HH et TP, respectivement) ne sont pas affectées par les stratégies d alimentation suivies (P = 0,40 0,58 et 0,25 pour les facteurs lot, type de fourrage et niveau de concentré, respectivement). Ce résultat est en accord avec les résultats d autres auteurs (Sami et *al.,* 2004 Varela et *al.*, 2004) et indique que tous les régimes ont apporté l énergie suffisante pour avoir une évolution normale du pH *post mortem*.

Le Tableau 3 présente la surface des fibres musculaires et leur activité enzymatique pour les muscle RA et ST. Ni le type de fourrage ni le niveau de concentré affectent la surface des fibres. Ce résultat est en accord avec les observations de Listrat *et al.* (1999), Maltin *et al.* (2001) et Sami *et al.* (2004). Jurie *et al.* (1999) obtiennent des différences sur la surface des fibres musculaires chez des animaux ayant eu différences de GM supérieures a les observées dans cette expérimentation (d environ 640 g/jour). Le lot TP présente des surfaces de fibre les plus élevées pour le muscle ST, significativement plus élevées (P<0,05) que celles des lots FH et HB. Ce résultat est en accord avec les observations de Jurie *et al.* (1998). Ces auteurs associent l augmentation de la surface du logement et la possibilité d une activité physique plus forte avec une augmentation de la surface des fibres du muscle ST.

Ni la nature du fourrage ni le niveau d apport d aliments concentrés n ont d effet significatif (P 0,1) sur les activités enzymatiques LDH, PFK, ICDH et CS. L activité CO des lots HB, HH, FB et FH semble être supérieure dans le cas d un apport important d aliments concentrés (P = 0,13). Les résultats obtenus en divers études suggèrent une relation entre l alimentation l herbe ou l ensilage et un métabolisme oxidatif des muscles plus importante (Jurie *et al*., 1999 Listrat *et al.,* 1999). Les résultats obtenus dans ce travail sont en accord avec les observations de Maltin *et al.* (1998). Ces auteurs ne observent pas des différences sur l activité enzymatique des muscles de taurillons alimentés l ensilage d herbe ou avec une ration base d orgue. L activité enzymatique CS est significativement différente pour le lot TP sur le muscle ST (P = 0,06) et présente une valeur plus élevée que les lots FH et HB (P<0,005). Cette observation est en accord avec les résultats de Jurie *et al*. (2004). Selon ces auteurs l activité physique, associée au p turage, peut se révéler un facteur influen ant les caractéristiques métaboliques des muscles plus importante que l alimentation.

Ni la teneur totale en collagène (4,64 3,87 5,32 5,49 et 4,79 μg OH-prol par mg MS pour les lots FB, FH, HB, HH et TP, respectivement) ni la quantité de collagène insoluble (3,83 3,68 4,29 4,33 et 3,43 μg OH-prol per mg DM, pour les lots FB, FH, HB, HH et TP, respectivement) ne sont affectés par les stratégies d alimentation suivies (P 0,1). Dans la bibliographie existent nombreuses résultats contradictoires sur l effet de la vitesse de croissance et la nature de l alimentation sur la teneur et composition du collagène (Maltin *et al*., 1998 Listrat *et al*., 1999 Sami *et al*., 2004).

La teneur en lipides du muscle RA (68,7 mg/g de matière sèche) (Tableau 3) est très faible même en comparaison avec les résultats obtenus par autres auteurs pour le muscle LD, un muscle réputé pour être relativement maigre (Maltin *et al*., 1998 Varela *et al*., 2004) et n est pas affectée par les traitements mis en place (P 0,1). La teneur en lipides intramusculaires peut varier en fonction de plusieurs facteurs comme l ge, la race et la vitesse de croissance. De fa on générale la teneur en lipides est plus élevée pour les animaux plus gés, avec des vitesses de croissance élevées et pour les races d orientation productive mixte par rapport les races viande (N rnberg *et al*., 1998). En prenant en considération ces observations le faible contenu en lipides intramusculaires observé pourrait être expliqué par l ge relativement bas d abattage des animaux et par leur vitesse de croissance très modérée.

L effet lot est significatif pour la tendreté et la jutosité (P = 0,01 et 0,003 respectivement) (Tableau 4). En particulier, le lot témoin au p turage révèle une tendreté et une jutosité moindre (P<0,05) que les lots FH et HH.

Les résultats sur les caractéristiques métaboliques et histologiques des muscles indiquent que les animaux au p turage ont des muscles plus oxydatifs et constitués de fibres plus grosses. Plusieurs auteurs (Jurie *et al.,* 1998 Renand *et al.,* 2001) associent ces caractéristiques une viande moins tendre mais pas moins juteuse (ce dernier paramètre est plus associé d autres caractéristiques, telles que la teneur et la nature des lipides de la viande, (Geay *et al.*, 2002). Ces différences de jutosité pourraient s expliquer par la corrélation entre les notes de tendreté et jutosité (r = 0,46 P<0,0001). Cette observation sur la tendreté moindre de la viande des animaux au p turage pourrait, peut être, être modulée en pratiquant des périodes de maturation plus longues que celles utilisées

dans ce travail (8 jours). Ce fait met en évidence l effet possible de la durée de la période de maturation entre la production et la commercialisation de viande de qualité produite l herbe. Il ne ressort pas de différence sur la flaveur des viandes, alors qu un effet de la nature très différente des fourrages aurait pu être attendu.

Tableau 4. Evaluation sensorielle

	FH	HH	TP	s.e.	Lots	Juré
Tendreté	5,17[a]	5,42[a]	4,14[b]	0,96	0,01	0,004
Jutosité	4,60[a]	4,79[a]	3,63[b]	0,75	0,003	<0,0001
Flaveurs						
Métal	1,48	1,43	1,48	0,67	0,98	<0,0001
Sang	1,59	1,11	1,16	0,67	0,25	<0,0001
Lait	0,87	1,07	1,01	0,41	0,57	<0,0001
Graisses	0,88	1,00	0,96	0,65	0,92	<0,0001
Herbe	0,87	0,93	1,06	0,49	0,72	<0,0001

a, b : Les moyennes d une même ligne avec ces suffixes différent significativement, (P<0,05).

Conclusion

La nature des rations a un effet assez limité sur les performances des animaux, les caractéristiques des carcasses et la qualité des viandes. Les résultats obtenus pour le lot au p turage suggère que l activité extérieure peut avoir un effet sensible sur les caractéristiques des muscles et la qualité de la viande sur le critère de tendreté.

Les viandes obtenues se caractérisent par une teneur très faible en lipides intra musculaires. Cette caractéristique se révèle favorable pour ce type de produit dans un contexte de demande de viande bovine maigre.

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Effects of the supplementation of olive cake and cactus pad silage on sheep intramuscular fatty acid composition

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SUMMARY – Twelve Barbarine lambs were fed barley and soybean meal concentrate: six lambs were also supplemented with oat hay (H group), while the other six animals were supplemented with silage based on olive cake and cactus pads (S group). Lambs were slaughtered after 92 days of treatment at the age of 242 days. Intramuscular fatty acid composition was determined on m. longissimus dorsi. Meat of the animals supplemented with the silage contained higher levels of C18:2n-6 ($P<0.05$) and lower C18:3n-3 ($P<0.01$) compared to the meat from the lambs supplemented with hay. Saturated fatty acids (SFA) were present at higher levels ($P<0.05$) in the meat of animals of the H group compared to meat from the animals of the S group. The n-6/n-3 ratio was higher ($P<0.000$) in the fat of the sheep fed the silage diet compared to meat of the animals fed the hay diet.

Keywords: Cactus pads, fatty acids, lamb, meat quality, olive cake.

RESUME – "Effets de la supplémentation avec un ensilage de grignon d'olive et de raquettes de cactus sur la composition en acides gras intramusculaire des ovins". Douze agneaux de race Barbarine ont reçu pendant 92 jours un régime à base d'orge et de tourteau de soja supplémenté avec soit du foin d'avoine (groupe H; n = 6), soit un ensilage à base de grignon d'olive et de raquettes de cactus (groupe S; n = 6), puis ont été abattus à l'âge de 242 jours. La composition en acides gras intramusculaires a été déterminée sur le muscle Longissimus dorsi. Comparée à celle des agneaux du groupe H, la viande des agneaux du groupe S présentait des proportions de C18:2n-6 plus élevées ($P<0,05$), des proportions de C18:3n-3 et d'acides gras saturés plus faibles ($P<0,01$ et $P<0,05$, respectivement), et un rapport n-6/n-3 plus élevé ($P<0,001$).

Mots-clés : Acides gras, agneau, grignon d'olive, qualité de la viande, raquettes de cactus.

Introduction

In recent years there is an increasing interest for the exploitation of some alternative feedstuffs for animal farming in the Mediterranean Countries. Some agro-industrial by products (olive cake, citrus pulp) and some arid-environment shrubs (cactus, Acacia cyanophylla, Atriplex spp.) have a good potential use as alternative feeding resources (AFR). Among the agro-industrial by-products, olive cake presents a high level of crude fat and a low content of crude protein (Molina Alcaide and Nefzaoui, 1996) and recent studies have focused on the nutritional value of olive cake in small ruminant diets (Martín García et al., 2003). Cactus pads are characterized by high percentages of water (85-95%) and soluble carbohydrates, but they are low in crude protein and fibre (Ben Salem et al., 2002; Atti et al., 2006). Recent researches have reported that the supplementation of cactus pads in small ruminants diet in combination with a source of nitrogen is an effective resource for animal nourishing (Ben Salem et al., 2002).

Meat fatty acid composition exerts important effects on consumers' health. It has been demonstrated that high levels of saturated fatty acids (SFA) as well as a high value of the n-6/n-3 fatty acids ratio in human diet increase the incidence of cardiovascular diseases (Enser et al., 1998), while fatty acids of the n-3 series and conjugated linoleic acid (CLA) are beneficial to human health (McGuire and McGuire, 1999). The aim of the present study was to investigate the intramuscular fatty acid composition of meat of lambs offered a silage based on olive cake, cactus pads and wheat barn as supplement to a concentrate diet.

Materials and methods

Twelve male Barbarine lambs at age 143 d were randomly assigned to one of two experimental treatments: six animals were offered oaten hay *ad libitum* (H group), while the second group of lambs (S group) received *ad libitum* a silage based mainly on olive cake, and containing also chopped cactus pads and wheat bran. Both groups of lambs received also 300g/d of a concentrate based on barley and soybean meal and they were gradually adapted to the experimental diets trough a 7 days period. After 92 days of experimental trial, animals were slaughtered. Carcasses were halved into side and stored at 4°C. Twenty-four hours post-mortem the right muscle *longissimus dorsi* was excised and stored at -25°C until chemical analysis. Intramuscular fatty acids were extracted from a 5 g meat sample according to Folch *et al*. (1957). Fatty acids were quantified as fatty acids methyl esters (French *et al*., 2000). The gas-chromatograph used was a Thermo Finnigan, TRACE. Separation of 1 *µ*l of fatty acid methyl esters in hexane was done by a capillary column Supelco SP-2340 in fused silica. Feed fatty acid composition was determined according to Sukhija and Palmquist (1988) (Table 1). Data on meat fatty acid composition were analysed by ANOVA with a model including treatment effects and experimental error.

Table 1. Chemical composition of the ingredients in the diets

	Ingredients			
	Oaten hay	Silage	Soybean meal	Barley
Dry matter (%)	93.6	93.5	93.1	92.2
Crude fat†	1.10	10.7	1.12	1.77
Fatty acids††				
C 12:0	0.27	0.03	0.04	0.05
C 14:0	1.53	0.09	0.12	0.28
C 16:0	20.15	11.80	15.71	17.83
C 16:1	0.72	0.26	0.23	0.32
C 18:0	6.15	2.90	4.16	1.96
C 18:1 cis-9	17.99	55.30	11.66	18.55
C 18:2n-6	37.37	23.72	51.42	50.56
C 18:3n-3	15.81	5.90	16.64	10.44
SFA	28.10	14.82	20.04	20.12
UFA	71.90	85.18	79.96	79.88

†Values expressed as percent of dry matter.
††Values expressed as g/100g fatty acids methyl esters.

Results and discussion

Oaten hay and silage had the same dry matter content, while the silage contained considerably higher levels of crude fat compared to oaten hay. Oleic acid (C18:1 cis-9) was three times higher into the silage diet compared to oaten hay while C16:0, C18:0, C18:2n-6 and C18:3n-3 were at higher levels in oaten hay compared to silage. Silage contained higher percentages of unsaturated fatty acids (UFA) compared to oaten hay (Table 1).

The high level of oleic acid in the silage diet was expected because this fatty acid is largely predominant in olive oil and wastes. According to Atti *et al*. (2006) chopped cactus pads is rich in linoleic and linolenic acids however cactus has a low ether extract content and moreover in the present trial the percentage of cactus pads included in the silage was too low to increase the content of C18:2n-6 and C18:3n-3 of the diet.

Interestingly, the content of oleic acid in lambs intramuscular fat was not different (P 0.05) among the two treatments. The replacement of oaten hay with the silage did not influence the content of conjugated linoleic acid (CLA) and of C18:1 11-trans, which are produced during the

biohydrogenation of linoleic and linolenic acids by microrganisms in the rumen (Bauman et al., 1999). The meat of the lambs of the S group contained higher levels (P<0.05) of linoleic acid than the animals of the H group. Silage had a higher ether extract (10.7% vs 1.1% of DM, Table 1) compared to oaten and this can have played an effect on the intramuscular content of linoleic acid. Moreover, the higher NDF content of the hay diet could have favoured ruminal biohydrogenation of linoleic acid (Sackmann et al., 2003) resulting in a lower accumulation of C18:2n-6 in the fat of the H lambs compared to the fat of the S lambs. Linolenic acid was detected at higher (P = 0.003) percentages in meat of the lambs offered oaten hay compared to lambs fed the silage, and this result reflected diet fatty acid composition (Table 1). Total saturated fatty acids (SFA) were present at lower (P<0.05) percentages in the intramuscular fat of the animals receiving the silage, while mono-unsaturated fatty acids (MUFA) and poly-unsaturated fatty acids (PUFA) were not affected by treatments. Meat of the animals of the H group contained higher percentages of total n-3 fatty acids and lower n-6 fatty acids (P<0.05) compared to meat of the lambs of the S group. The n-6/n-3 ratio was higher (P<0.001) for the meat of the silage-fed animals compared to the hay-fed lambs (Table 2).

Table 2. Effects of the treatments on intramuscular fatty acid composition† of m. longissimus dorsi

	Treatments			
	Hay	Silage	SEM	P††
No. of lambs	6	6	-	-
C 16:0	21.44	20.18	0.037	NS
C 18:0	13.08	12.81	0.315	NS
C 18:1 11-trans	1.96	2.36	0.126	NS
C 18:1 9-cis	26.22	26.07	0.551	NS
C 18:1 11-cis	2.35	2.57	0.064	NS
C 18:2 n-6	13.27	17.19	0.841	0.011
C 18:2 9-cis, 11-trans (CLA)	0.85	0.86	0.029	NS
C 18:3n-3	1.81	1.30	0.098	0.003
C 20:2n-6	0.12	0.13	0.015	NS
C 20:3n-3	0.16	0.12	0.014	NS
C 20:4n-6	6.19	6.86	0.367	NS
C 22:1	0.17	0.20	0.022	NS
C 20:5n-3	1.99	1.69	0.131	NS
C 22:5n-3	2.08	1.89	0.097	NS
C 22:6n-3	0.71	0.87	0.082	NS
SFA	39.87	36.48	0.825	0.032
MUFA	31.83	31.88	0.616	NS
PUFA	28.30	31.61	1.180	NS
Total n-6	20.87	24.73	1.220	0.032
Total n-3	6.99	5.68	0.273	0.047
n-6/n-3 ratio	2.99	4.37	0.240	0.000
Other fatty acids†††	7.60	5.03	-	-

†Values expressed as g/100g identified fatty acids methyl esters.
††NS = not significant.
†††C12:0 + C14:0 + C14 :1 + C15:0 + C15:1 + C16:1 + C17:0 + C17:1 + C18:2 10-cis, 12-trans + C18:3n-3 gamma linolenic.

Conclusions

The replacement of oaten hay with a silage based on olive cake and cactus pads in lamb diet induced a higher content of linoleic acid and lower percentages of linolenic acid in the fat of

m. *longissimus dorsi* of the S lambs compared with the H lambs. Treatments did not affect the concentration of conjugated linoleic acid in meat. The total amount of saturated fatty acids (SFA) was lower in the fat of the lambs offered the silage compared to lambs supplemented with oaten hay. However, meat of the animals fed the silage had a value of n-6/n-3 ratio higher compared to animals fed hay, resulting in a fatty acid composition less favourable for human health.

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SESSI

Changes and new trends in the distribution and consumption of products of animal origin in Mediterranean countries

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Differentiation strategies and marketing networks: Evidence from breeders in two marginal areas of Tuscany

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SUMMARY – In this paper we analyse two different marketing networks developed by farmers in marginal rural areas to add and retain value to produce. In order to better understand whether differentiation could be a real option for marginal areas, the paper deals with the development and the performance of product networks created around local products. The analysis is based on two case studies in Tuscany. The first case study concerns the evolution of the marketing network around the raw milk sheep system of production of the Pistoia Mountains. The second case study illustrates the marketing strategies recently developed by a well established co-operative of beef producers in the Mugello area. In this case, the differentiation concerns organic beef marketed nationally by a big retailer. The comparison of the two cases shows that successful differentiation is linked to capacity to keep control of the chain through appropriate network-building activities.

Keywords: Raw sheep milk cheese, organic beef, differentiation strategies, niche markets.

RESUME – *Stratégies de différenciacion et réseaux de marketing : constats des éleveurs dans deux ones marginales de oscane . Cet article analyse deux réseaux différents de marketing développés par des éleveurs dans des ones rurales marginales pour ajouter de la valeur aux produits et la retenir. Afin de mieux comprendre si la différenciation peut vraiment représenter un choix pour les ones marginales, cet article étudie le développement et les performances des réseaux productifs créés autour de produits locaux. L'analyse est basée sur deux études de cas en oscane. La première étude de cas concerne l'évolution du réseau de marketing autour du système de production de lait cru de brebis des montagnes de Pistoia. La deuxième étude de cas illustre les stratégies de marketing récemment développées par une coopérative de producteurs bovins bien établis dans la one de Mugello. Dans ce cas, la différenciation concerne la viande bovine biologique commercialisée à l'échelle nationale par un gran distributeur. La comparaison des deux cas montre qu'une différenciation réussie est liée à la capacité de garder le contr le de la cha ne à travers des activités appropriées de mise en place de réseaux.*

Mots-clés : *fromage à base de lait cru de brebis, viande bovine biologique, stratégies de différenciation, marchés de niche.*

Introduction

Farmers networking strategies can be an effective means to contribute to sustainable agricultural development. In this paper we analyse two different marketing networks developed by farmers in marginal rural areas to add and retain value to produce. Within this context, it focused on the link between marketing networks and the concepts of differentiation strategies and development pathways. In the literature, differentiation has been extensively studied and presented as a possible solution for increasing the sustainability in environmental, economic and social terms. Most studies identified differentiation as an adjustment strategy to cope with a changed context for farming (Ilbery, 1991, Ilbery *et al*., 1996), and it has been mainly studied within the broader context of alternative food networks. In order to better understand whether differentiation could be a real option for marginal areas, the paper deals with the development and the commercial performance of those networks, which are built on the basis of a broad alignment of interests among different actors of the local system of production: producers, retailers, processors, institutions, consumers and so on.

The analysis is based on two case studies in Tuscany. The first case study concerns the evolution of the marketing network around of the raw milk sheep system of production of the Pistoia Mountains. In the northern areas of Tuscany shepherds have, over a long period, adopted a strategy whereby they internalise both processing and marketing activities. Through such strategies intense social networks, involving producers and local consumers in close interpersonal relations based on trust were established in the past. More recently such strategies have become the basis of the re-positioning of the product on high quality cheese markets, in which external consumers have been involved and can appreciate its specific qualities. In this case, Slow Food[1] has played a crucial role in this process, providing the necessary symbolic capital to increase the reputation and the differentiation of the product and to enlarge the original distribution network.

The second case study illustrates the marketing strategies recently developed by a well established co-operative of beef producers in the Mugello area. In this case, the differentiation concerns the development of an organic beef marketed nationally by a big retailer. As a result, the co-operative lost both the ability to retain added value within the region of production and its initial mission, which was to strengthen the autonomy of farmers in the supply chain and to use quality as a key differentiation strategy. The case underlines the importance for the organic sector to find innovative distribution networks in order to preserve the authenticity of the values embedded in a traditional production system.

Sustainable agriculture and differentiation strategies

Marginal farms are among the most endangered by the modernisation of the agro-food system, a process amplified by the increasingly power of large-scale food processors and retailers. Besides their traditional social exclusion, several studies (Ilbery *et al*., 2004 Meert *et al*., 2005) show that at least a significant proportion of the farm households face structural and income problems, resulting in a high rate of abandonment in several rural areas, associated with increasing social and cultural erosion processes. Nevertheless, some farmers took up the challenge to overcome this process of marginalisation by exploring and developing new pathways, reflecting in part increasing societal concerns over the environment and food safety.

These pathways are closely intertwined with the emergence of alternative food networks, within which "producers, consumers, institutions and other actors embody alternatives to the more standardised industrial modes of food supply" (Renting *et al*., 2003 Murdoch, 2000). According to the literature (Ilbery *et al*., 2004 Meert *et al*., 2005) we can see that many of such strategies might represent means to make reconnections between producers and consumers, and marginal rural areas could benefit from the "quality turn" in food production and a relative shift from long food supply chains to shorter and very diversified distribution networks. A growing body of literature analyses the role that place can play in these strategies (e.g. Winter 2003 DuPuis and Goodman 2005, Goodman, 2003 Ilbery, B. and Kneafsey 2000 Murdoch 2000). For instance, the attempts to differentiate food on the basis of the territorial origin –food relocalisation strategies– aims at grounding relations between producers and consumers on acknowledgement, respect and trust (Ilbery and Maye, 2005 Sage, 2003 Ilbery and Kneafsey, 2000 Hinrichs, 2003 Winter, 2003). Several authors have recognised that this clearly emerged within short food supply chains (Marsden *et al*., 2000 Renting *et al*., 2003): along short food supply chains producers are able to communicate to consumers the traditional production systems, the place of production and other distinctive quality assets of the product (Renting *et al*., 2003 Ilbery and Maye, 2005).

Overall, therefore, building alternative food networks could enable farmers to retain higher degree of local control over the production, marketing and distribution of their products (Hinrichs, 2000

[1] Slow Food was created in 1986 as a cultural organisation aiming at the spread of quality-food awareness through the re-discovering of local quality produce, or "for the defence of and the right to pleasure" (Petrini, 2001). In 1989 Slow Food becomes an international organisation, but its international and national level remains connected with local networks through local units called *Condotte* in Italy, *Convivia* abroad. Through the *Ark of aste* project, set up in 1996, the association formally starts an activity aimed at saving typical and traditional products, which are bound to disappear because of industrial standardization, environmental degradation and hyper hygienist regulations. The operational units of that project are the *Presidia*, a type of collective branding through which the association gives technical and communicative support to the initiatives aimed at saving specific products. See Petrini (2001).

Winter, 2003). On the other hand, products reach the consumer embedded with information, enabling them to make connections and associations with the place of production (Renting *et al*., 2003). Nevertheless, it has been highlighted that the evolution of alternative food networks could be driven by an increasing adherence to the economic imperatives bringing to a change of the initial mission (Buck *et al*., 1997 Guthman, 2004). Furthermore, without a careful management of the network and of the growth, the turn to quality could be driven mainly by large producers, processors and retailers, who appropriate the original values and meanings of quality produce. Therefore, alternative food networks face a dilemma: commercial performance is the key factor for the further development of such strategies, but at the same time, commercial success could hide the risk to loose the original alternative values. This paper offers an analysis of the network building process and questions the commercial performance of two alternative food networks. The relevance of commercial performance can be assessed with reference to a conventional marketing perspective, by considering as indicators the attractiveness of the market and the competitive position. To better assess these aspects related to the production system we have used the McKinsey matrix (Table 1 Fig. 1, Fig. 2), which correlates the two dimensions of the commercial performance: the attractiveness of the market with the competitive position of the initiative.

Table 1. Indicators for market attractiveness and competitiveness

Criteria[2]	Indicators
Market attractiveness	• Market size and growth rate • Competitive intensity/rivalry • Market profitability • Opportunities to differentiate the product and services • Overall risk of return in industry • Distribution structure and negotiation power of the clients
Competitive position	• Price differential and value added • Ability of the organisation to co-ordinate the commercial strategy • Product quality and image of the region of production • Potential of innovation • Customer loyalty • Relative brand strength • Ability to promote the product

Food supply chains in two marginal areas of Tuscany

The Raw Milk Sheep s Cheese (RMSC) from the Pistoia Mountains

The production of raw milk sheep s cheese in the mountainous area of Pistoia Province[3] is a centuries-old tradition in a region where small scale and extensive livestock farming, based on a local sheep breed (Massese) is one of the main economic activities. In contrast to sheep breeding systems in other parts of Tuscany, where shepherds traditionally supply milk to cheese makers, on-farm processing of milk is commonly practiced. As a result a large number of the inhabitants of the area have extensive experience of sheep s cheese production, following long established methods based on unwritten but widely accepted rules. They produce a range of distinctive cheeses, whose specific characteristics are derived from the use of raw milk (heated to a maximum of 30-32 C) and curdling with natural rennet. The farmers have, over a long period, adopted a strategy in which they internalise both processing and marketing activities. Through such strategies intense social networks, involving

[2] To build a MacKinsey matrix a system of scores and weights of the relevant parameters of competitiveness is needed. In our case, weights have been set by the research team on the basis of the answers of the people interviewed (for a presentation, see www.valuebasedmanagement.net/methods _ge_mckinsey.html).

[3] The mountainous area of Pistoia Province of Tuscany is a marginal region which faces considerable development constraints.

producers and local consumers in close interpersonal relations based on trust were established in the past. Nerveless, in the end of 90 s, the survival of the traditional system of production of raw milk sheep s cheese came under threat with the implementation of new European and national hygiene regulations for the dairy sector. Shepherds faced increasing constraints posed by the hygiene authorities, being forced to make difficult adaptations and significant changes to the structure and functioning of whole farms (including production and processing methods) in order to comply with the regulations.

Two institutional actors recognised the very velar need to preserve the cheese and the basic principles of its production process: the director of the local breeders association (APA) and the Slow Food local *"Fiduciary"*[4] (the local representative). Between them they pioneered an initiative intended to preserve the quality and characteristic of the cheese. Once the importance of action to preserve the traditional method of production by shepherds was recognised, the Director of the APA started to involve the whole community and the key actors within the cheese supply chain in this crucial issue, by instigating intense interactions with the local Health Authorities, the Regional Administration and the University. This later move progressively helped change the attitude of the local Health Authorities, which had initially opposed the use of raw milk and was strongly inclined towards adopting a more restrictive approach to control. At the same time, Slow Food s representative in Tuscany identified the raw milk sheep s cheese from the Pistoia Mountains as a traditional product undergoing a critical change, which fitted with the aims of the *Presidia*[5]. As a result Slow Food s *Fiduciary* in the Pistoia Mountains made contact with the local shepherds in order to discuss the idea of creating a Slow Food *Presidium*. In 2001 the Director of the APA succeeded in drawing up technical specifications that would allow the shepherds to continue using raw milk, through more formalised control procedures to ensure an adequate safety level. This step was fundamental for legitimating the traditional production techniques to the outside world and for strengthening the cohesion between the shepherds and their institutional environment.

This Code of Practices facilitated the creation of the Slow Food *Presidium*. At the same time the Chamber of Commerce pushed for the creation of a new organisational form in order to consolidate and facilitate the actions of the *Presidium*. In response to this suggestion, the Director of A.P.A. promoted the establishment of the "*Consortium of the Pistoia Mountains and Valleys*" in 2002. Most of the shepherds (24) became members of this, together with other local institutions[6], which became involved in providing some level of economic support for the Consortium s further development. Once the organisational structure was formalised, the next step of the process was valorising the product through marketing. Previously the raw milk cheese had only been sold within the region of production, and local consumers thought of it as a "normal" cheese. Slow Food s involvement provided the necessary symbolic capital to increase the reputation of the product, to differentiate it from other kinds of sheep milk cheese, and to give it a higher profile in the outside world. The shepherds belonging to the Consortium were supported in their involvement in other marketing and promotional activities, being involving in local fairs[7], as well as in Slow Food events at the national and international level, including the International Halls of Taste and of Cheese. Such recognition made it possible to expand the traditional pattern of farm-gate direct selling and to sell the raw milk sheep s cheese to restaurants and agri-tourism businesses, and to connect local circuits with national and international market outlets.

Assessing the commercial performance

In the case of RMSC we can see that the good commercial performance has been the key factor for the further development of the network, which has been built around the local system of production.

[4]At that time the issue of local quality foods and their close links with artisanal ways of production was becoming a topic of public interest in Italy. The emergence of the Slow Food movement is an example of this, and helped to instil this new awareness. There was a growing concern that changes to traditional production methods required to meet new hygiene regulations would lead to these unique products, representing part of Italy s rich culinary patrimony, becoming standardised and homogenised and thus losing their distinct quality.

[5]At the national level, Slow Food was highly involved in identifying local production systems that were in danger of extinction because of the effects of standardisation.

[6]The Municipality of Cutigliano, the Pistoia Mountains Community (*Comunità Montana*) and the Province of Pistoia.

[7]The Show of Pistoia Shepherds Products and the Shepherds Fair, both held in Cutigliano village.

The raw milk sheep cheese was, and still is, mainly sold on the local (provincial) market. As already mentioned, the farmers have, over a long period, adopted a strategy in which they internalise both processing and marketing activities. More recently such relationships have come to form the basis of the re-positioning of the product on high quality cheese markets, in which also external consumers can perceive and appreciate its specific qualities. The alliance with Slow Food was crucial in valorising the product in a wider area: it has allowed the cheese to be more widely recognised and to be sold in the well-established circuit of restaurants and markets linked to Slow Food. Nowadays the RSMC is known and sold in various restaurants and eno-gastronomic events at national level and consumers go to the area of production in order to buy this cheese.

Indicators for market attractiveness (able 2)

Table 2. Factors affecting market attractiveness of raw milk sheep cheese network

Indicators	Weight	Grade on 10
Market size and growth rate	5%	2
Competitive intensity/rivalry	40%	6
Market profitability	5%	5
Opportunities to differentiate the product and services	30 %	6
Overall risk of return in industry	0 %	0
Distribution structure and negotiation power of the clients	20 %	8
Total	100 %	6.15

(i) *Market si e and gro th rate***.** The raw milk sheep cheese is by the most important cheese in the region of production, with almost of 50% of the whole cheese sales volume in the Pistoia Province. The rate of producers belonging to the Consortium in relation to the all shepherds of the area (22 out of 47) shows the importance of this organization on the territory. However, the total production is only 280 t per year[8], which in terms of volume is not a sufficient level to penetrate regional or national markets of high quality sheep cheese. This relevant market includes the main competitors, which are all the other quality sheep cheeses produced in Tuscany and in other parts of Italy.

(ii) *Competitive intensity/rivalry*. In the "external" market outside Tuscany the cheese has a weak competitiveness in relation to other high quality products. There are a lot of other sheep cheeses, even if few of them are made with raw milk.

(iii) *Market profitability.* Farming is very hard in the lagging areas: traditionally farms that are too small, or whose structure is insufficiently adjusted to modern standards and techniques. One opportunity for the farmers in the Pistoia mountains has been to join to the Consortium, which insures the adequate technical support and the selling of the cheese within broader market outlets. The main positive factor is represented by the greater valorisation of the capitals used (sheep, labour, structures and machinery) due to the growth of the sales and also to the increased prices of the product.

(iv) *Opportunities to differentiate the product and services*. The opportunities to differentiate the product and the services are very diverse, in relation to the artisan nature of the produce, the different period of ripening and the possibility of processing with special ingredients.

(v) *Overall risk of return in industry*. Low

(vi) *Distribution structure and negotiation po er of the clients*. Very short channel (farmer s market, small shops in the area and manifestations) where consumers (above all no-local ones) rarely negotiate prices.

[8]The raw milk sheep cheese of the Pistoia Mountains has increased steadily in terms of production of around 14% since the Consortium was constituted in 2002.

Indicators for competitive position (Table 3)

Table 3. Factors affecting competitive position of raw milk sheep cheese network

Indicators	Weight	Grade on 10
Price differential and value added	10	7
Ability of the organisation to co-ordinate the commercial strategy	25	8
Ability of the organisation to negotiate with retailers	25	9
Product quality	10	6
Image of the territory	1	1
Customer loyalty	7	4
Relative brand strength	2	2
Ability to promote the product	20	9
Total	100 %	7.68

(i) Price differential and value added:

- Price premium at consumer level. The price premium paid by consumers for the raw milk sheep cheese ranges from 10.5% up to 58% above the price for common sheep cheese. This premium price is reached by marketing the cheese outside the region of production thanks to the strong promotion efforts offered by Slow Food and by the Consortium of the cheese producers (e.g. at fairs for typical and traditional produces). On the other hands, in the region of production the price difference to other of the quality sheep cheeses usually stays below a plus of 20%.

- Value added at producer level. The strategy elaborated by this initiative led to functioning and diversified channels of distribution allowing to pay a price premium to the producers. As the Consortium of the Italian sheep cheese was able to organize and open up new marketing possibilities (e.g. higher consumer price achieved by sale at fairs) they can realize a premium. Compared to the conventional (traditional) chain (where the cheese is sold directly on farm or within the local retailers), the premium price within a fair or other events could reach till +58% (+3.50 €/kg). Another strategy has been to build a strong network which leads to a powerful marketing and finally to a high degree of recognition of the product or the brand. The network around the production of the cheese was able to build new marketing strategies, by connecting to larger networks, which give to the to the local production system new opportunities to maintain their specificities and, at the same time, to improve their commercial performance. As matter of fact, selling the product at particular fairs like the local "Show of Pistoia Shepherds' Products" the "Shepherds' Fair" and the international "Hall of Taste and Cheese" (organized every two years by Slow Food in Turin, Italy), has provided the possibility to increase price paid to producers and to valorise the value capitals at the basis of the cheese production.

(ii) Ability of the organisation to co-ordinate the commercial strategy. There is not a real commercial co-ordination even if the Consortium and the creation of the Presidium has helped the shepherds to increase their marketing and communication skills. The Consortium has greatly improved the self-organisational capacity of the small-scale shepherds, mainly by strengthening relationships between them and increasing their participation in decision making processes. An increase in bridging capital between local producers and external consumers has occurred, due to the efforts made to increase consumer's confidence, through emphasizing the traditional and the natural.

(iii) Product quality. The production of this cheese can be considered strongly linked with the territory: autochthons sheep breed have been farmed on that mountains for many years and farmers have adapted their farming practices accordingly. As already mentioned, the raw milk production has been badly damaged by the sector's regulation and health warnings at the end of 1990's. However, the process of legitimation through the creation of an adequate Code of Practices and a collective

brand provided a symbolic representation of the product and production system, reinforcing a sense of internal identity, and creating and communicating an image of quality to the outside world. Furthermore, throughout the reputation of Slow Food, the Consortium has succeeded in strengthening consumers' involvement. Unfortunately, in the "external" market outside Tuscany the cheese has a weak competitiveness in relation to other high quality products. The above mentioned attributes like regional, tasty, traditionally and rural are difficult to communicate to consumers as unique attributes. There may be similar products that also argue with those attributes (coming from different regions).

(iv) *Image of the Pistoia Mountains*. The image of the area is different from the common Tuscany representation; the area is still a place to be discovered by tourism. The initiative is based on the interaction between product and territory.

(v) *Potential of innovation.* Very low as it is a traditional produce, and the initiative is aimed at keeping traditional techniques and ways of ripening.

(vi) *Customer loyalty.* High loyalty between producer and his clients: the good market share can be related to the strong relationship between the producers and other actors within the food supply chain. This type of "strengthening of the chain" can be ascribed to the motivations which led consumers go to buy the cheese directly for the producers: mainly the taste and pleasure (42.5%[9)], but also because to the wish to maintain the tradition and character of the territory (25.0%). Besides all, for consumers, it is the opportunity to actively engage in a more direct relationship with the food they buy, which includes having a human-level relationship within the producers. On the other hands, thanks to the Slow Food activities, producers have enhanced their skills to talk about the production methods employed, and more in general about the values beyond their cheese. Usually the development of s such relationship based on trust with producers gave consumers more confidence in the food they were buying.

(vii) *Relative brand strength*. Very low as consumers pay more attention to the origin of the product or to the direct contact with the producer than to the presence of the collective brand.

(viii) *Ability to promote the product*. Very good as the initiative benefits from the Slow Food promotion of the products.

Figure 1 shows the position of raw milk sheep cheese in the McKinsey matrix.

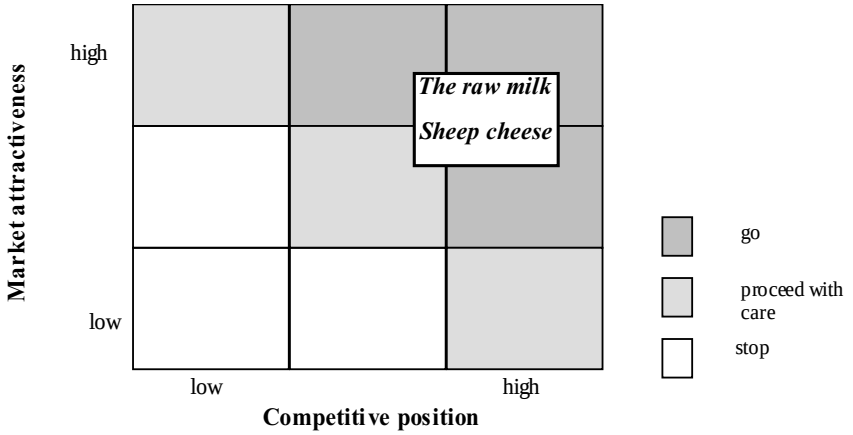

Fig. 1. McKinsey matrix for the raw milk sheep cheese.

Overall, we can see that the strategy of revalorising raw milk sheep's cheese has created new opportunities for capturing NVA in the region, as well as increasing the producer's share of the retail. It has positioned the product within local markets for high quality cheese and also provided new marketing outlets, attracting higher retail prices. In this case both the production system and the valorisation process drew heavily upon local resources (the local breed of sheep, pastures,

[9]The percentage refers to a survey carried out within the framework of the case study.

processing skills), which gave the product a strong specificity, which has subsequently been built upon to reinforce the visibility of the whole rural area, through developing synergies between direct selling, agri-tourism activities and local fairs and markets.

The Agricultural Co-operative of Firenzuola

The Agricultural Co-operative of Firenzuola (CAF) was created in 1972 by a group of breeders in the higher part of Mugello, a marginal rural area of Tuscany. It was established in response to the weakness of producers on local beef markets. At that time, the area had a large proportion of milk farms, and the local calves were considered as "only" by-products of the dairy industry. As a result wholesalers preferred to buy beef cattle from the specialised and intensive livestock farming in the North-Eastern regions of Italy. The goals of the co-operative were to improve the collective strength of farmers in the supply chain, to avoid the dependence on middlemen, and create the possibility for slaughtering and directly marketing the local beef. Since then, the cooperative has attempted to retain control over the whole meat production chain, by taking over a public abattoir and also setting up some sales outlets in the area where the beef could be sold. The volumes sold by the co-operative and the number of involved members have rapidly increased. Farmers were keen to join the co-operative, as it could assure them a stable market and consumers were pleased by the possibility of "buying locally" and reacted very positively to the initiative.

The starting point of an organic network that was developed within the CAF can be traced back to 1997-98. At that time, the BSE alarm had showed the fragility of the conventional beef market, and there had been a dramatic decline in beef consumption during the six months following the first outbreaks. Some co-operative members within the more marginal area of Mugello decided to convert to organic production, partly encouraged by the availability of subsidies from the Regional Government. Converting to organic farming seemed, at the time, to imply only minor changes in their system of production, as they already were working with low-external input breeding systems. The development of this network necessitated addressing a range of issues: from a marketing perspective, CAF members expressed concern about the possible competition within the region between two these competing modes of quality production – the traditional and the organic meat. For this reason, they sought a different way of positioning the organic beef which would not threaten the position that the traditional product had established in local markets. At the outset the co-operative forged an alliance with Esselunga, a national retail chain. Under this agreement, their organic beef was exclusively sold in Esselunga outlets located in Firenze and Milano, under the organic CAF label[10]. Under the pressure of increasing market demand, the co-operative board took the decision to accept new members, even though most of the breeders interested in applying did not come from within the initial boundaries of the Mugello production area, and their farm-size was, on average, larger than that of the pioneer farms. At the end of this phase, CAF had developed an extended network, with two different sets of farmers, with their products being sold through separate channels: conventional beef sold mainly in CAF stores to local consumers, and organic beef in more distant supermarket outlets.

The contradictions inherent in the new, extended, network started to emerge in 2003, when the market for only organic beef declined owing to general downturn in the economy. As a consequence, Esselunga started paying organic beef less and the CAF board were obliged to reduce the prices that they paid to farmers[11]. Organic farmers strongly complained about this decision, as they claimed that costs of organic production exceeded the price that they were receiving, especially because of certification costs and the purchase of high quality feed. Some of the smaller producers considered abandoning the organic certification. The situation worsened when in the second half of 2004 the demand for CAF organic beef fell dramatically. Consumers were less willing to pay a premium, and. as a consequence, Esselunga dropped organic beef from the shelves in its stores in Milano, and the store in Firenze cut its order by 40%, before breaking its agreement with the co-operative in June 2005. This put the organic producers within CAF in a very difficult position, and the problem of finding alternative channels became urgent. This uncertainty about the future strategic choices of the co-

[10]The partnership with *Esselunga* provided a strong stimulus to the local production system: the number of slaughtered organic calves increased from less than one per week in 1998 up to 10-15 in 2003.

[11]The premium price shifted from 1.5-1.8 /kg, (25-30% more than the conventional one) in 2000-2001, to about 1 /kg (more than 20% below the conventional price) in 2003-2004.

operative, has led CAF organic breeders to start thinking about other possible paths for promoting and marketing their organic beef. At the moment, they appear to be moving towards partial relocalisation and seeking to avoid reliance on another retailer as their sole customer. Furthermore, they have started to involve various local actors, including other organic producers, local institutions, researchers and technicians, to revitalise the link with the territory. Through this emerging network, the idea of creating a local outlet for selling a range of local organic produce, promoted on a territorial basis, is taking off.

Assessing the commercial performance of CAF beef

In this case, even if the market size of the organic initiative is not relevant in relation to the conventional reference market (less then 1% in terms of volume of sales), the co-operative represents one of the biggest supplier of organic meat in the area.

Indicators of market attractiveness (able 4)

Table 4. Factors affecting market attractiveness of the CAF initiative (network)

Indicators	Weight	Grade on 10
Market size and growth rate	35	5
Market profitability and pricing trends	10	8
Competitive intensity /rivalry	10	5
Opportunities to differentiate the product and services	10	6
Distribution structure and negotiation power of the clients	35	4
Total	100 %	5.05

(i) *Market si e and gro th rate*. Even though the total organic production is only 109,266 kg/year, the co-operative represents the biggest supplier of Italian organic meat negative potential growth rate. Unfortunately, the recent decrease in organic meat demand affects negatively the potential for further development of the initiative.

(ii) *Market profitability and pricing trends*. The profitability related to the pricing trends appears to be positive, because at consumer level prices of organic beef are still very high in comparison with prices of conventional meat.

(iii) *Competitive intensity/rivalry*. The competitive intensity on the market is very strong due to the relevant presence on the national market of imported organic beef (mainly from North Europe or France) and the conventional meat (local non organic) with other quality specificities (such as the Chianina breads).

(iv) *Opportunities to differentiate the product and services*. At the moment, the opportunities appear related to be moving towards partial relocalisation and seeking to avoid reliance on another retailer as their sole customer. For instance: (i) selling their products in dedicated organic shops at national level (ii) participating in organic fairs at the national level and (iii) setting up a purchase group.

With respect to the product differentiation, a good opportunity in order to add more value added to the produce, could be to process the meat in order to make sauces and other products which can be differently used.

(v) *Distribution structure and negotiation po er of the clients*. Long channel (supermarket), where consumers are not able to negotiate prices.

Indicators of competitive position (able)

Table 5. Factors affecting competitive position of CAF initiative (network)

Indicators	Weight	Grade on 10
Price differential and value added	30	4
Ability of the organisation to co-ordinate the commercial strategy	20	4
Ability of the organisation to negotiate with retailers	8	4
Product quality	10	5
Image of the territory	8	6
Customer loyalty	6	5
Relative brand strength	8	5
Ability to promote the product	10	5
Total	100%	4.5

(i) *Production volume and gro th rate potential:*

- Price premium at consumer level. The premium price paid by consumers in June 2005 is about 27% above the price of the national conventional beef and up to 53% above that of the imported conventional meat. Compared to imported organic meat the price differential is about 30%.
- Δ value added at producer level. A decreasing premium to organic producers goes along with losses in demand. The most important outlet, a supermarket chain, stopped selling the co-operative s organic meat, making marketing very difficult. In 2004, the price premium received by farmers was still 1 per kg above the price of conventional meat, but did not cover the higher production costs of organic farming.

(ii) *Ability of the organisation to co ordinate the commercial strategy to ards the consumers*. The organisational performance of the organic initiative has been quite low, particularly as it has been progressively losing credibility among external consumers. The organic network is currently in a process of re-orienting itself, concentrating its efforts on consolidating the alliances between local food actors and other organic networks, and developing synergies between organic beef production and other local resources. This has the potential to enhance self organisation capacity, involve consumers and increase social cohesion and inclusion, all of which are the pre-conditions for the emergence of a more stable and dynamic local network.

(iii) *Ability of the organisation to negotiate ith retailers*. The co-operative has a weaker power of negotiation in relation to the big retailer. Furthermore, the fact that the growth in organic selling has been dependent only upon one form of retailing has increased the vulnerability of the organic network. Esselunga has been able to keep power in the chain for its capacity to influence marketing choices at all levels of the chain, and in particular for its ability to retain the control on the communication of the products values.

(iv) *Product quality*. The result has been that organic labelling has not been strong enough to create an alternative food chain, by strengthening the differentiation of the product on the market. External consumers, with whom CAF hardly can communicate, only perceive the "ecological" value of the beef. In other words, the alliance with Esselunga made the product lose its identity and connection with the area of origin and product s embedded features. Furthermore, the technical aspects related to organoleptic quality should not be underestimated. In fact, there is a general agreement within the co-operative that organic standards don t allow to reach the same levels of eating quality that conventional production in Mugello could reach. Basically, the common idea among consumers is that the colour of the organic meat is darker and its consistency is stronger than the conventional one, due to the high development of the animals muscles, as the organic regulation imposes a longer period on the pastures. On the contrary, "local non organic" CAF producers, with their localised chain, have succeeded in building a quality image linked to the territory without having to pay the costs of organic

production and certification. The capacity to retain control of the chain allowed also for a step towards a strengthening of its local identity while trying to introduce some "ecological" elements into its production system, and the most important tool in this sense has been the CAF label ("Le Mugellane"), through which the co-operative succeeded in differentiating its products and to ensuring consumers that the whole cycle of production is performed in Mugello.

(v) *Image of the territory*. The Mugello area is has a very reputation among outside citizens, with a landscape quite different from the common Tuscany representation.

(vi) *Customer loyalty*. Local consumers trust the local non organic CAF beef and attribute to it a high quality status, and actually perceive a higher "eating" quality. On one side this is because they are not allowed to compare between organic and conventional, and therefore the option left to them is simply between "local" and "anonymous conventional". Conversely, the organic labelling didn t succeeded in strengthening the external consumer loyalty, according to the reasons before mentioned. Increasingly, CAF organic beef is perceived as one among many others.

(vii) *Relative brand strength*. In the organic beef production, an own brand was created by the co-operative, but without a complete promotion strategy for organic meat being implemented. The meat which is retailed with the supermarket s brand resulting in the CAF co-operative s brand losing its "visibility".

(viii) *Ability to promote the product*. Very low, the promotion has been carried out only by the big retailer company.

According to a marketing perspective, resulting in the Mc Kynsey Matrix (Fig. 2), CAF organic beef has already reached a good competitive position (good market share), but at the moment its position is threatened by the negative market setting, which affects the potential growth rate of the organic product sale. As a whole the co-operative, has contributed to added value in the region, and providing a significant direct outlet for traditional beef, it has facilitated the financial stability of its members. However, the economic performance of the organic initiative has been less successful: the exclusive marketing relationship with the large retailer led to the co-operative losing its ability to retain added value within the region of production. As a result the co-operative was not able to meet one of its initial aims, which was to strengthen the producers retails share. In addition, the dependency on one customer, Esselunga, made producers vulnerable to external pressures and in consequence the organic labelling proved inadequate in creating a steady market. This is an inherent risk when bottom up initiatives seek to engage with more conventional supply chains. Often the process of growth can bring about an increased adherence to narrow economic imperatives and a change to the initial mission.

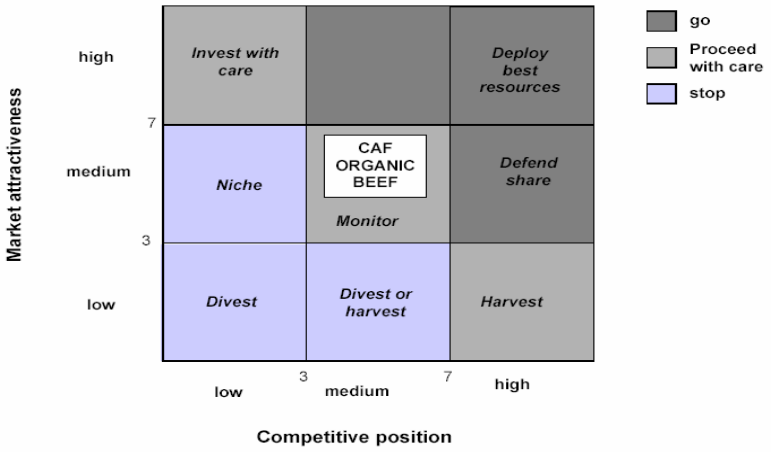

Fig. 2. Mc Kynsey Matrix of the CAF organic beef.

Conclusion remarks

This paper has questioned the effectiveness of farmers networking strategies in contributing to sustainable agricultural development. In particular, using the Mc Kynsey matrix attempts have been made to identify and to weigh the key factors likely to influence the performance of two case study in Tuscany. The overall success of food distribution networks is manly determined by a wider concept of commercial performance. In this respect, various aspects have been analysed. Firstly, from the analysis of the two case studies, it emerges that alternative distribution networks have to deal with *various strategies* to maintain or *increase the market po er of producers*. For instance, in the raw milk sheep cheese case, the strategy elaborated by this initiative led to diversify market channels allowing to pay a price premium to the producers. As the Consortium of the Italian sheep cheese has been able to organize and starting up new marketing possibilities (with higher consumer price achieved by sale at fairs) producers are able to realize a premium. Furthermore, shepherds retain control over the marketing of the cheese and hold decision-making power regarding prices due to direct sale. Conversely, in the CAF case the exclusive marketing relationship with the large retailer led to the co-operative losing its ability to retain added value within the region of production. As a result the co-operative was not able to meet one of its initial aims, which was to strengthen the producers retails share. In addition, the dependency on one customer made producers vulnerable to external pressures and in consequence the organic labelling proved inadequate in creating a steady market. In other words, we can see that a strong extension of marketing structures and distributive networks might result in a loss in credibility and authenticity.

Another key feature that distinguishes these kind of networks is the focus on "quality". In this respect, a focus on quality can encourage producers to create and to communicate a strong *product image* closely linked with the region of production. The raw milk cheese is a very good example of this: thanks to the support offered by Slow Food, the Consortium was able to build a strong symbolic capital around the product linking its qualitative attributes to local natural resources and traditions, and to promote it widely. In the CAF case, the "local non organic" CAF producers, through their localised chain, have succeeded in building a quality image linked to the territory without having to pay the costs of organic production and certification. On the contrary, the organic meat which is retailed with the supermarket s brand resulting in the loss of product image visibility. The consequence has been that organic labelling has not been strong enough to create an alternative food chain, by strengthening the differentiation of the product on the market. External consumers, with whom CAF hardly can communicate, only perceive the "ecological" value of the beef. In other words, the alliance with Esselunga made the product lose its identity and connection with the area of origin and product s embedded features.

Overall, it would appear that the success of an initiatives is depending on its capacity for finding a market "niche". Yet, the development of speciality products will not happen alone. Other aspects, notably the establishment of new and accurate alliances need to be made between producers and outside stakeholders from other distribution networks or institutions, offer much grater potentialities for the further development of such "diversified" strategies.

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Commercial distribution: Current situation and trends. Opportunities

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Modern distribution plays a very important role in current trade as it provides consumers with the products that satisfy their household needs (foods, cleaning products, electric appliances, furniture or even services).

Focusing on food products, the subject of concern, distributors provide consumers with products from the primary sector, either directly or indirectly, through manufacturers, intermediaries, wholesalers, etc. In the case of direct access to the primary sector, distributors manage the purchase and slaughter of animals directly, as well as jointing, packaging and distribution of the manufactured products through their own platforms to the sales outlets. Direct purchases to producers are based on lasting, reliable and profitable partnership relations for both parties, as a result of which an agreement is reached on a common list of conditions, stating the characteristics of the process and product, which in turn is translated into consistent products and services. In principle, this may seem very simple but markets are constantly changing and in most cases the environment cannot be totally controlled.

In todays s society several changes are taking place, giving rise to various circumstances which are making food consumption habits develop very quickly, both from the viewpoint of the type of products as well as their format. Thus, it is very important that modern distribution understands what frame of reference we are working in.

First of all, we have to know the environment we are not able to control, which may be determined by factors such as the legal, economic, technological, and socio-demographic frameworks. In fact, the latter is providing a very specific picture of the current and future situation, which affects distributors considerably when adopting commercial strategies. It should be pointed out that the population in Spain is getting older, the "senior target" is increasing, and by the year 2010 it is estimated that around 60% of the population will be between 25 and 64 years old. Of even more concern is the fact that almost 20% of the population will be over 65. Besides, if it had not been for immigrants, the birth rate was declining dramatically year after year until the end of the 90s. On top of this we have to take into account that in the last decade the number of households has increased but the total population has not increased at the same pace, and as a result the average household in Spain has less than 3 members, and more significantly, 20% of these households have a single member - in other neighbouring European countries the percentage may be as high as 26%.

Besides, family budget allocation has changed now more is spent on housing, leisure, culture and training and less is spent on food, in global terms –in Spain only 2 out of 10 is spent on food and in the USA they have already reached 0.9 out of 10. That is, we are living in a society where consumers have high education levels and are very much concerned about the environment, quality, food safety, information and leisure, factors that were less valued in former times.

Under this paradigm, the themes that rule motivation and buying impulses are: in the first place, health and personal care, hence the concern about safety, the development of functional, light foods, etc. Next, convenience, easy and quick to prepare foods, since we are a society "poor in time" and for this reason we are observing the emergence of new products that facilitate preparation and are quick and easy to use. Finally, fads and personal prestige, where we have to know how to combine products and services of high face value at a reasonable price and the cheaper the better, hence the term "cheap - chic", which refers to a combination of low prices and aesthetics, fashion and glamour. Important business groups are already operating in this field mainly in the clothing and restaurant

sectors in the food business we have a clear example in the wine sector, where the traditional production sector has added to its products perceived values which exceed their real values and at prices that are more than reasonable through very attractive labels and a very interesting marketing effort. Likewise, in the food sector, some manufacturers have already worked in developing powerful, modern and attractive packagings, as in the case, for instance, of bottled water, filleted meat, "patés", etc. even developing new product designs like for instance, "roscas", which are in fact ready-to-bake common donought-shaped bread rolls.

For these reasons, modern distribution has to learn to manage an attractive supply of products and to attract consumers who are becoming less and less loyal to the shop, who visit shops less often, that is, consumers shop less often but they spend more money. Furthermore, the average time they spend at the shelves is very short, and thus we have to attract their attention when they visit a shopping mall with suitable value for money products (high development of distributors brands), with very safe products, an attractive and interesting selection and provide elements such as convenience, cleaning and order inside the shop, in accordance with the consumers' demands, and in fact this is what they say when asked. Besides, the shopping activity is becoming more planned and rational and less impulsive. Another important change that is taking place in consumption habits is the shift towards consumption at home, with a decrease in consumption out of the home, shown by data of some manufacturers.

The situation of the food market is also being affected by the strong concentration of the distributors and the manufacturers, due to the continuous demand, year after year, for profits, which means that processes have to be optimised and purchase volumes grouped together in order to improve costs, since the increase in benefits through a rise in prices is increasingly more difficult because of the great competetition that exists on the market. This is leading to a more and more evident polarity between the market leader brands and the brands developed by the Distribution, in detriment to other brands put on the market by manufacturers with less market power and furthermore, real subsistence probems arise in the business fabric of the Agrofood Sector. In fact the top 5 distribution operators in Spain hold a market share of 50%, but for example in countries such as Sweden, Norway and Holland, the first 3 groups hold more than 80% market share, with a growth in the last year of more than 12%, far above the average growth of the market, at around 6%.

Distribution is classified in 3 main groups or business formats: Discount (or Hard Discount), a price-oriented format that does not give so much value to the brand. The Supermarket, where a multitude of strategies are being developed to capture consumers who are saturated with such a large commercial offer, however, which is the fastest-growing channel in m^2 sales surface area and in turnover, above 8%. And the Hypermarket, where the varied supply of brands gives rise to a very attractive selection for the customer and where the purchasing volumes permit very aggressive prices. It is noteworthy that the greatest distributor in Spain has a market share of nearly 20%.

The weight of distribution in Spain in the meat sector would not be as large, as the traditional channel, made up of markets, specialised and traditional shops and also own-consumption maintains shares at around 40-50% of the total market. In the case of the processed meats the share of the traditional channel is much smaller, around 25%, in favour of modern distribution, with shares approaching 70% between the Super and Hyper channels.

Of the total grocery basket, approximately 22% is made up of meat products, which would be encouraging for the sector except that meat is a category of products that has only grown by a volume of 3% in the last five years. Of that piece of the cake, chicken, pork and processed meats lead the consumption of meat products, holding around 70% of the consumption. In recent years beef and lamb consumption has decreased, as well as that of frozen meats, which, with a share of only 3%, cannot escape the dead weight of this type of product as in the back of the consumer's mind is the idea that they are products of lower quality than fresh products, distributed at the beginning in areas where access to this type of product such as meat, fish and vegetables in general was more difficult, whereas this is far from true, since they are products with an identical transformation to that of the fresh product, but whose final transformation takes place in a freezing tunnel in order to facilitate its subsequent transport, distribution and conservation. Therefore, manufacturers and distributors are making great efforts to change this perception by making changes in the products, adding value, making changes in the presentation and even in the exhibition and implantation in the shopping malls,

all of which is conveyed through specific marketing campaigns for this type of product where manufacturers and distributors work in close collaboration with each other.

Furthermore, it is to be considered that pork and poultry are the categories that have evolved most in the new consumption patterns, with an important development of new presentations, special cuts, new packaging and even ready-to-eat prepared dishes. In fact, this is confirmed by a survey that has been conducted among consumers in order to determine the weight of the consumption of different meat products according to type of household where we observe that chicken and pork are the favourite products among young people, whereas beef, lamb and rabbit are the products preferred by households made up of members over 50 without children.

After analysing the sociodemographic changes that are taking place in society today, as well as the consumption habits and patterns that are evolving in the food market, we should be capable of gathering enough clues to be able to seek opportunities that we should address from commercial distribution.

In summary, we have seen that the age of the consumers is rising and therefore the target customer is increasingly more adult, the number of single-parent households is rising, the expenditure in food is stabilising in favour of other budgetary items. The aspects that are currently very highly appreciated are health, safety, personal care, time-saving, comfort, speed and fashion and personal prestige. The food crisis has led to a growing sentiment of mistrust and thus the need for safety, leading to the development of quality brands, certifications and controlled productions, all of which fall under the umbrella of distributors brands. Also noteworthy are the changes that are taking place in the distribution channels, where self-service is increasing constantly, and great importance is given to packaging and product information. This is due to the fact that consumers visit the commercial establishments less and less frequently, and therefore are encouraging the promotion of packages that increase the shelf-life of the product.

With all this data, we have to know how to identify the opportunities that arise in the light of the changes in consumer priorities and as regards the market. On one hand, as we have indicated previously, we have to face the lack of confidence and the need for the consumer to feel safe through certified products, controlled production products, quality marks and supplier homologation programmes. On the other hand, we have to satisfy the needs created by social changes and changes in habits: through trays and portions better adjusted to the household size, prepared foods ready to cook and consume, joints that are easy to use and prepare, packages that guarantee a longer shelf life and new products with added value, targeted towards a consumer that positively values innovation.

In the needs satisfaction pyramid it is important to point out that between the safety and pleasure zones, leisure, interpersonal and power relationships, the need for an adequate and healthy nutrition is gathering strength, hence the strong development experienced by the so-called functional foods, with annual growth at around 14%, based on the development of products of basic consumption or commodities to which certain substances are added to improve some of the most common bodily functions: according to Datamonitor, in 2004, 27% of functional foods were targeted at cardiovascular function, 24% to the digestive function and almost 15% to the locomotor apparatus, in particular bones. Some authors qualify functional foods as those that eliminate from their composition natural substances such as salt, sugar or fats whose presence in foods could make certain conditions worse. Today functional foods are being studied to improve problems of interest today such as the lack of sleep, stress, obesity, or even cell ageing. As regards health, a series of products aimed at overcoming intolerance to foods or food allergies, for example to gluten, to help celiacs practise a healthier diet in the light of their problem.

Finally in this section on health and nutrition, we should not forget the awareness of today's society of dietary products derived from transgenic productions (GMOs, especially maize and soybean), contrasting two different ways of seeing reality: on one hand the detractors that wish to show that genetic manipulation of crop seeds could have repercussions of the health of the final consumer, and on the other hand, those in favour, who argue that these possible negative repercussions have not been proven and besides, defend that the traditional production systems have a very negative environmental impact on the Earth and that it would be necessary to have much greater cropland areas in order to obtain the same result. At the moment the consumer has not sided with one party or

another other, they only demand the necessary information in order to know what they are consuming. Aware of this debate and of the demand for information, the EU has already developed a label law, according to which it is necessary to inform of which foods have ingredients of GMO origin. Logically, distribution is not foreign to this social debate and some operators in the EU have already withdrawn products that contained GMOs from their shelves and have conveyed this to their customers.

Conclusions

Times are changing in the distribution of food products, bringing about new challenges which require a better adaptation to the environment, both by the manufacturers and by the distributors. No longer should we not only be product-oriented but also much more customer-oriented, basing competivity not only on both product and price, but also on service and on customer service, on the relations and community factors and on experience as a basis for future transformation. As regards the possible future evolution of distribution, a sustained decline in the traditional channels is expected, concentration movements of regional supermarket chains, a growth in commercial surface area through small convenience store formats (more favoured by opening licences than the bigger hyper-type formats), a growing regime of franchises and, in general, a greater concentration of distribution to reach the size that is necessary in order to survive.

Attentes et attitudes des consommateurs urbains face aux produits laitiers : Cas de la commune de Tunis

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RESUME – Le présent article analyse les attitudes et les perceptions des consommateurs face au lait et produits dérivés dans la commune de Tunis en se basant sur une enquête par questionnaire. Les résultats obtenus ont permis de vérifier que le comportement du consommateur est la résultante de la confrontation de la perception qu'il a du produit (attributs du produit) et du point de vente (attributs du magasin) avec ses attentes liées à sa situation socio-économique d'achat (attributs de situation). Quels que soient la catégorie socio-économique et le quartier de résidence les attributs de qualité perçus par les consommateurs de Tunis sont essentiellement la fraîcheur, la salubrité et l'hygiène du produit. Pour s'en assurer ils font confiance à certaines marques et surtout à l'épicier du quartier qui demeure le lieu d'approvisionnement le plus fréquenté. La situation socio-économique des ménages a une influence plutôt sur les quantités et les types de produits laitiers consommés, d'où une consommation plus importante et plus variée chez les catégories socio-économiques les plus aisées. Toutefois, pour la quasi totalité des ménages les prix constituent une contrainte à la consommation.

Mots-clés: lait et produits laitiers, consommation, perceptions, attitudes, attentes, attribut produit, attribut situation, Tunis.

SUMMARY – "Expectations and attitudes of urban consumers regarding dairy products: The case of the city of Tunis". This article analyses consumer attitudes and perceptions to milk and dairy products in the city of Tunis following a questionnaire-based survey. The results obtained show that consumer behaviour is the result of confronting their perceptions towards a given product (product attributes) and a given point of sale (shop attributes) against their expectations, which are linked to the socio-economic situation regarding the purchasing activity (situation attributes). Regardless of the socio-economic level or the place of residence, quality attributes as perceived by consumers in Tunis are essentially related to freshness, healthiness and safety of the products. In order to be sure, consumers trust certain brands and they especially trust the grocery store in their district where they normally buy food products. The socio-economic situation of the household has an effect, but mainly regarding the quantity and type of dairy products consumed, thus, greater and more varied consumption is observed among wealthier socio-economic groups. However, price is the main limiting factor in consumption for most households.

Keywords: Milk and dairy products, consumption, perceptions, attitudes, expectations, product attributes, situation attributes, Tunis.

Introduction

La filière lait en Tunisie a subi des changements profonds au cours des deux dernières décennies en raison de l'évolution des orientations de la politique agricole et alimentaire. En effet, depuis le milieu des années 80, consécutif au Programme d'Ajustement Structurel Agricole (PASA), plusieurs mesures d'appui et de promotion du secteur ont été prises dans le but de réduire les importations et d'atteindre l'autosuffisance à l'horizon 2000. A partir de 1994, une stratégie nationale de développement du secteur a été mise en œuvre se basant sur des politiques intégrées de production, de collecte et de transformation ayant permis d'enregistrer un accroissement continu des performances de l'ensemble de la filière.

La production de lait a été de ce fait multipliée par plus que cinq en trente ans, soit 934 millions de litres en 2001 contre 167 millions de litres en 1970 (ONAGRI, 2003) permettant ainsi à la Tunisie de passer au cours des dernières années d'une situation de déficit à une situation de surproduction.

Parallèlement, l'industrie laitière a aussi connu un développement très rapide de ses capacités de production gr ce d une part l'entrée de nouvelles unités privées attirées par l'évolution du marché et d autre part aux accords d'association avec des entreprises leaders au niveau international. Cette dynamique a permis la diversification et l'amélioration de la qualité des produits. Le développement de la cha ne du froid et de la grande distribution a joué un r le important au sein de la filière. Les quantités transformées ont enregistré un accroissement moyen de 6,5% par an pour le lait, de 6,1% pour le yaourt, de 22% pour le fromage et de 13% pour les dérivés frais (leben, raieb) (ONAGRI, 2003).

Ce développement n'est pas sans conséquences sur la consommation alimentaire qui est passée de 46 kg par tête et par an (en équivalent lait frais) en 1980 78 kg par tête et par an en 2000 (INS). Toutefois, on observe un écart important entre le milieu urbain et le milieu rural. On consomme actuellement prés de deux fois plus de lait et de produits laitiers en ville qu' la campagne (94,7kg contre).

Comme la population tunisienne est 61 % une population urbaine, cette urbanisation rapide joue certainement un r le important dans la croissance accélérée de la consommation dans les villes et dans les changements d'habitudes qui s'y opèrent. Le présent article s'interroge sur le comportement des consommateurs vis des produits laitiers en tentant d'identifier leurs attitudes et leurs perceptions face ce type de produits. Le champ d analyse retenu est la commune de Tunis.

Cadre theori ue et methodologie de recherche

En vue de mieux comprendre le comportement des consommateurs face aux produits laitiers, il s'agit d'appréhender les différents liens entre le consommateur et le produit et le consommateur et le point de vente. L'analyse de la rationalité du comportement est basée sur des facteurs économiques dont les prix des produits, mais il fait de plus en plus appel aux facteurs psychologiques individuels dont les perceptions et les attitudes.

La perception telle que définie par Kotler et Dubois (1997) est "le processus par lequel un individu choisit, organise et interprète des éléments d'information externe pour construire une image cohérente du monde qui l'entoure" L'attitude est définie par Padilla et al. (2001) comme "l'orientation positive ou négative du consommateur l'égard d'un produit ou d'une marque". Elle intègre l'ensemble des caractéristiques qu'un consommateur per oit ou attribut un produit, l'image qu'il se fait du produit ainsi que ses intentions pour l'acquisition du produit. Les perceptions que se fait un consommateur d'un produit sont basées selon Oude Ophuis et Van Trip (1995 cité par Sirieix, 1996) sur des indicateurs et des attributs de qualité (Tableau 1).

Tableau 1. Indicateurs et attributs de qualité

Indicateurs de qualité intrinsèques	Indicateurs de qualité extrinsèques
Apparence	
Couleur	
Forme	
Taille	
Structure	
Marque	
Attributs de qualité tangibles	**Attributs de qualité intangibles**
Go t	Santé
Fraicheur	Salubrité/hygiène
Commodité	Caractère exclusif (rareté)
Respect de l'environnement	Conditions de production

L approche "POS" ou "le paradigme Personne-Objet-Situation" (Bloch et Richins, 1983 cité par

Padilla et al., 2001) considère le produit comme un ensemble d'attributs pouvant satisfaire les attentes du consommateur. Ces attentes dépendent des situations socio-économiques de consommation, variables d'un individu l'autre. Dans ce sens, les comportements l'égard d'un produit donné sont la résultante de la confrontation de la perception qu'a l'individu du produit (attributs du produit) avec ses attentes liées sa situation d'achat (attributs de situation).

L analyse du comportement des consommateurs quant aux nouvelles formes de distribution et au choix des points de vente d une fa on générale se base sur le modèle multi-attributs que proposent Monroe et Guiltinam (1975 cité par Padilla et al., 2001). Ce modèle intègre plusieurs variables liées aux propres indicateurs du distributeur (attributs de magasin), notamment la confiance per us par le consommateur, introduite par Howard (1989) et aux caractéristiques de l'acheteur dont la fréquentation des magasins et le planning des achats.

Les données utilisées sont issues d'une enquête par questionnaire réalisée auprès d'un échantillon de 150 ménages répartis dans 30 unités primaires de district de la ville de Tunis[1].

Consommation des menages en lait et produits laitiers dans la commune de Tunis

Consommation par produit

D'une fa on générale, on relève que le lait et les yaourts sont les deux principaux produits laitiers les plus consommés, suivi du beurre et du fromage fondu achetés et consommés néanmoins en plus faibles quantités.

Lait frais et lait industrialisé

Le lait stérilisé UHT, conditionné industriellement sous forme de bouteilles en plastiques ou de packs en carton, est nettement plus consommé que le lait frais vendu en vrac non stérilisé et non conditionné (85% de l échantillon). Toutefois, 28% des ménages sont encore fidèles la consommation de lait en vrac, dans des proportions en moyenne inférieures aux quantités de lait stérilisé (6 litres en moyenne/semaine/ménage contre 7 litres respectivement) (Tableau 2).

Les cités plus aisées d'El Menzah, présentent le taux de consommation le plus faible en lait artisanal (7% des ménages), même s'ils en consomment une quantité plus élevée(11 litres en moyenne par semaine).

Les catégories socioprofessionnelles des chefs de famille qui consomment le plus de lait artisanal sont celles des ouvriers, des cadres moyens et des employés. Ils représentent respectivement 36%, 29% et 26% des ménages appartenant ces catégories. La consommation de lait industriel est l'inverse plus élevée dans les catégories des patrons de l'industrie et du commerce (92% des ménages de cette catégorie), des professions libérales et cadres supérieurs (94%).

La quantité de lait consommée ne présente pas de différences significatives entre les ménages selon leurs catégories socioprofessionnelles l'exception des ménages appartenant aux professions libérales et cadres supérieurs dont la consommation moyenne est plus élevée, soit 11 litres/semaine/ménage pour le lait frais en vrac et de 9 litres/semaine/ménage pour le lait industriel alors qu'elle varie pour le reste des catégories entre 6 et 7 litres/semaine/ménage respectivement.

La consommation moyenne en lait au niveau des ménages diminue lorsque le nombre d'enfants augmente. Cette diminution est remarquée partir du 4ème enfant pour le lait industriel passant de 8 6 litres/semaine/ménage. Par ailleurs, le nombre de ménages qui en consomment augmente avec le nombre d'enfants. Ce qui traduit que la présence d'enfants dans le ménage est un critère important pour l'achat du lait (Tableau 3).

[1]L échantillon est obtenu par tirage systémique, fraction de sondage aléatoire, en prélevant un sous échantillon de ménages sélectionnés dans gouvernorat de Tunis partir d'un échantillon mère (1300 ménages) suivi par l'Institut National de Nutrition et de Technologie Alimentaire dans le Grand Tunis.

Tableau 2. Consommation moyenne du lait et des produits laitiers par ménage (Source: Nos calculs partir des données de l enquête)

Produits laitiers	% Ménages	Consommation moyenne/ménage/semaine	Minimum consommé/ménage/Semaine	Maximum consommé/ménage/semaine
Lait frais en vrac	28	6†	0,5†	14†
Lait industriel (UHT)	85	7†	0,3†	35†
Lait concentré en boite	1	1†		1†
Lben artisanal	47	2†	0,1†	14†
Lben industriel	23	1†	0,1†	7†
Raib artisanal	19	2†	0,1†	7†
Raib industriel	24	1†	0,1†	7†
Beurre	93	279††	20††	1400††
Crème fra che	24	154††	25††	1250††
Yaourts	96	13†††	1†††	60†††
Fromage rouge	33	182††	10††	500††
Fromage fondu	69	275††	10††	2800††
Gruyère	27	194††	25††	750††
Fromage r pé	49	140††	25††	750††
Rigotte	54	264††	25††	1750††
Sicilien	5	207††	50††	500††
Sardaigne	3	125††	50††	250††
Smen	11	125††	50††	500††
Desserts lactés	19	9†††	2†††	49†††

†Litres ††Grammes †††Unités.

Tableau 3. Consommation moyenne de lait selon le nombre d'enfants par ménage (Source: Nos calculs partir des données de l enquête)

Nombre d enfants	Lait frais en vrac			Lait industriel UHT		
	% Ménages qui en consomment	uantité/semaine (litres)	Ecart type	% Ménages qui en consomment	uantité/semaine (litres)	Ecart type
Sans enfants	23	12	3	87	7	3
1	36	9	3	80	8	3
2	21	4	2	93	8	3
3	27	6	2	84	8	6
4	34	6	3	79	6	3
5	25	7	0	100	5	5
6	100	7	0	0	-	-
7	100	7	0	0	-	-
8	-	-	-	100	5	-

Produits laitiers

Concernant la consommation moyenne des produits dérivés du lait, les résultats soulignent une très faible consommation de produits traditionnels tels que les laits fermentés de type "ra b" et "lben", qu'ils soient de fabrication industrielle ou artisanale. Cette donnée montre un véritable changement d'habitudes alimentaires de la population urbaine de Tunis. Le yaourt qui est aujourd'hui consommé par 96% des ménages de l'échantillon raison de 13 unités en moyenne/semaine/ménage semble avoir remplacé les produits laitiers traditionnels de type "ra b" et "lben".

Des différences significatives existent entre lieu de résidence quant la consommation de yaourt. En effet, les cités plus populaires (Hrairia et de Bab Souika) présentent les taux de consommation

moyens par ménage les plus faibles, soit 7 yaourts par ménage. Par contre, dans les délégations plus aisées (El Menzah, par exemple), les ménages consomment en moyenne 22 yaourts par semaine, certains même atteignent 60 yaourts par semaine.

Le nombre de yaourts consommés par semaine évolue avec le niveau socioéconomique des ménages. Dans la catégorie des ouvriers et des retraités, certains ménages avouent même n'acheter qu'un ou deux yaourts occasionnellement dans la semaine pour le plus jeune enfant de la famille. Selon la taille des ménages, les ménages de plus de 5 enfants n'en achètent, en moyenne, qu'un seul par jour (Tableau 4).

Tableau 4. Consommation moyenne de yaourts selon le nombre d'enfants par ménage (Source: Nos calculs partir des données de l enquête)

Nombre d enfants	% Ménages qui en consomment	uantité/semaine (unités)	Ecart type
Sans enfants	100	16	14,8
1	100	13	8,9
2	92,8	11	11,6
3	100	14	10
4	87,5	12	7,8
5	100	10	4
6	100	7	-
7	100	7	-
8	100	7	-

Le "smen" (beurre rance), autrefois utilisé comme équivalent du beurre dans de nombreux plats tunisiens, semble dispara tre peu peu de la gastronomie tunisoise puisque substitué par la margarines et d'autres graisses végétales. Bien que 93% des ménages consomment du beurre, les quantités consommées sont autour de 200 grammes par semaine en moyenne. Certains ménages en consomment jusqu 1400 g par semaine. Le beurre est surtout utilisé pour le go té et le petit déjeuner des enfants.

Le fromage, est peu consommé par la quasi totalité des ménages et en très faibles quantités. La consommation des fromages de types Sicilien, Sardaigne, Fromage Rouge ou Gruyère, concerne au maximum 27% des ménages qui préfèrent plut t consommer du fromage fondu (en potions) des prix beaucoup plus bas (69% des ménages). La rigotte, un fromage tunisien traditionnel, est consommé par 54% des ménages.

Les desserts lactés et la crème fra che, gamme de produits laitiers fabriquée par diverses marques locales ou en partenariat, ne semblent pas encore être introduits dans le mode alimentaire des ménages car seulement 19% en consomment.

Fréquence de consommation

Le lait frais et le lait industriel UHT est acheté quotidiennement ou au plus 2 4 fois par semaine. Les autres produits laitiers, tels que le fromage, le beurre, le "ra b" ou le "lben", sont plut t achetés en moyenne une seule fois par semaine. On note, par ailleurs, que 72% des ménages n'achètent jamais du lait frais en vrac, 99% du lait concentré, 77% du "lben" artisanal, 88% du "raib" artisanal, 60% du gruyère, 83% du fromage Sicilien, 85% du fromage de Sardaigne, 89% du "smen" et 81% de desserts lactés (Tableau 5).

Pour le lait, la catégorie socioprofessionnelle des chefs de famille ne semble pas non plus être un facteur significatif influen ant la fréquence d'achat des consommateurs en lait, toutes les catégories s'en approvisionnent en grande majorité tous les jours.

Tableau 5. Fréquences d'achat du lait et des produits laitiers (en % ménages) (Source: Nos calculs partir des données de l enquête)

Produits laitiers	Jamais	Tous les jours	1 fois par semaine	2 4 fois par semaine	1 fois par 15 jours	1 fois par mois	Moins de 1 fois par mois
Lait frais en vrac	72	76	7	14	2		
Lait industriel (UHT)	15	68	14	16	1	1	
Lait concentré	99		100				
Lben artisanal	53	4	49	17	10	14	6
Lben industriel	77	3	35	9	6	18	29
Raib artisanal	81	7	38	24	7	14	10
Raib industriel	76	1	73	3	5	5	2
Beurre	7	25	40	24	2	5	4
Crème fra che	76		25	8	11	36	19
Yaourts	4	55	13	26	1	4	1
Fromage rouge	54	2	46	22	6	16	8
Fromage fondu	19	7	64	12	6	7	5
Gruyère	60	5	54	10	5	17	10
Fromage r pé	38	1	53	12	8	16	10
Rigotte	33	5	38	10	10	30	7
Sicilien	83		71			29	
Sardaigne	85		50			50	
Smen	89		25			38	38
Desserts lactés	81	24	31	21	10	7	7

Lieu d approvisionnement

Le lieu principal d'approvisionnement en lait et produits laitiers est très significativement l'épicerie, et ce, quelque soit la catégorie socioprofessionnelle des chefs de famille. Toutefois, quelques différences existent entre les produits (Tableau 6).

Tableau 6. Lieux d'approvisionnement en lait et produits laitiers par ménage (en % ménages) (Source: Nos calculs partir des données de l enquête)

Produits laitiers	Colporteur	Crémerie	Epicerie	P tisserie	Supérette	Grande surface
Lait frais en vrac	40	55	1	1	2	1
Lait (UHT)			85	4	2	8
Lait concentré						100
Lben artisanal	11	66	14	7		
Lben industriel		3	68		12	17
Raib artisanal		59	14		7	
Raib industriel		11	78	5	3	3
Beurre	1	4	81	2	4	8
Crème fra che			58	6	17	19
Yaourts		1	83	5	5	6
Fromage rouge		2	70	4	8	14
Fromage fondu_		1	84	4	6	6
Gruyère			61	2	12	17
Fromage r pé			82	4	5	4
Rigotte	1	56	24	4	6	6
Sicilien		14	29	14		43
Sardaigne		25	25			50
Smen	6	13	25			
Desserts lactés			72	7	7	14

Pour les produits laitiers de types artisanaux comme le lait frais en vrac, la rigotte, ou le "lben" et "ra b" artisanaux, la crémerie est lieu d approvisionnement le plus fréquenté. Toutefois, le colportage

est encore présent pour la distribution du lait frais en vrac. Il permet d approvisionner 40% environ des ménages. Ce mode d approvisionnement est surtout plus présent dans les délégations o quelques cités sont populaires (Bardo, Bouhaira et Sidi El Béchir). uant au lait industriel UHT, il est principalement acheté l'épicerie.

Pour l achat des yaourts, bien que l'épicerie soit le lieu d'approvisionnement le plus fréquenté quelque soit la délégation ou la catégorie socioprofessionnelle des chefs de famille, on remarque que dans les cités moins populaires de la capitale, les ménages s'en approvisionnent en partie dans les supérettes et les grandes surfaces. La catégorie des cadres moyens se trouve quant elle dans une situation intermédiaire car une partie d'entre elle achète ses yaourts en grande surface, comme les catégories aisées, et une autre partie la p tisserie comme les ouvriers et les non déclarés.

erceptions attitudes et attentes des consommateurs face au produits laitiers

Attributs de qualité

Plus de la moitié des personnes interrogées (56,7%) retiennent parmi les critères de qualité l'utilisation de lait frais. Une partie plus faible de consommateurs (13%) portent également une importance la rigueur des contr les techniques, hygiène de production et de distribution, ainsi qu' la conservation de la valeur nutritionnelle du lait (13%). Le maintient d'une certaine tradition dans les procédés de fabrication des produits laitiers ne semble pas être important en terme d'assurance de la qualité : seulement 11% des individus jugent que ce critère est prioritaire (Tableau 7).

Tableau 7. Critères de qualité des produits laitiers jugés prioritaires par les consommateurs (en % ménages) (Source: Nos calculs partir des données de l enquête)

	1 er critère	2 ème critère	3 ème critère
u'il soit un produit-partenariat	-	1	1
Le respect de la tradition de fabrication	11	5	2
L'utilisation de lait frais	57	12	3
La rigueur des contr les techniques	13	27	6
L'utilisation de procédés modernes	2	8	14
La conservation de la valeur nutritionnelle	13	16	3
Le go t	2	1	-
Ne sait pas	2	-	-
N ont pas répondu	0	30	17

Le consommateur est plus fidèle une marque de lait contrairement aux autres produits (Tableau 8).

Tableau 8. Fidélité pour une marque (Source: Nos calculs partir des données de l enquête)

	Fréquences des ménages (%)
Lait	
Achètent la même marque	61
Changent de marque	39
Yaourt	
Achètent la même marque	36
Changent de marque	64
Fromage	
Achètent la même marque	33
Changent de marque	67

Pour les yaourts et les fromages, la publicité semble également jouer un r le sur le choix du consommateur vis vis de la marque, et notamment sur les enfants. Néanmoins, l'effet du facteur prix sur le choix de la marque des fromages intervient plus significativement que la publicité (Tableau 9).

Tableau 9. Raisons de fidélité pour une marque donnée (% ménages) (Source: Nos calculs partir des données de l enquête)

	Lait		Yaourt		Fromage	
	1ère raison	2ème raison	1ère raison	2ème raison	1ère raison	2ème raison
Meilleure qualité	87	4	72	6	70	-
Publicité	2	1	17	7	4	2
Prix	6	-	9	2	18	-
Conseil du médecin	5	-	-	-	-	-
Marque ancienne	-	-	2	-		-
Seule marque disponible	-	-	-	-	4	-
Choix des l'aime	-	-			4	-
N'ont pas répondu	0	95	0	85	0	98

Attributs point de vente

65% des ménages enquêtés sont fidèles aux épiceries, 11% aux grandes surfaces et 7% respectivement aux p tisseries, crémeries et colporteurs. L épicerie demeure le premier lieu le plus fréquenté pour l'achat des produits laitiers quelque soit la catégorie socio-professionnelle. Cependant, le deuxième lieu d'approvisionnement varie en fonction de la catégorie socioprofessionnelle des chefs de famille. Les classes sociales aisées et moyennes c toient les grandes surfaces les ouvriers vont davantage la crémerie et les non déclarés, qui vivent avec des revenus instables, empruntent plut t le colportage ou les p tisseries (Tableau 10).

Tableau 10. Lieux d'approvisionnement les plus fréquentés selon les catégories socioprofessionnelles des chefs de famille (Source: Nos calculs partir des données de l enquête)

	Patrons industrie	Prof. libérales	Cadres moyens	Ouvriers	Retraités	Non déclarés
1er lieu le plus fréquent	Epicerie	Epicerie	Epicerie	Epicerie	Epicerie	Epicerie
2ème lieu le plus fréquent	Grande surface	Grande surface	Grande surface	Crémerie	Supérette	Colporteur et p tisserie

La fidélité pour le lieu d'approvisionnement, en l'occurrence pour l'épicerie, vient surtout du fait qu'il s'agit d'un commerce de quartier, donc de proximité, déclaré par 74% des ménages comme première raison de fidélité. Le commer ant et le consommateur se connaissent bien et se c toient régulièrement ce qui génère une confiance envers le marchand, qui accorde souvent des crédits (5% des consommateurs en bénéficient). uant la non fidélité pour un lieu d'approvisionnement, elle est liée en majorité (68% des réponses) l'indifférence pour le lieu d'approvisionnement et l'invariabilité des prix (21% des réponses) (Tableau 11).

Attributs du produit

Prés de la moitié des consommateurs préfèrent acheter des marques qu'ils connaissent 16% vérifient plut t la date de péremption comme seul critère de choix et 17% des répondants ont davantage confiance en leur marchand pour l'achat de produits qui répondent leurs attentes, sans

se fier la marque ou la date, optant ainsi pour le choix du commer ant. Ce dernier point est surtout lié au fait que quelques consommateurs sont analphabètes (15% des individus enquêtés) (Tableau 12).

Tableau 11. Raisons de fidélité pour un lieu d'approvisionnement (% ménages) (Source: Nos calculs partir des données de l enquête)

	1ère raison	2ème raison	3ème raison
La disponibilité de la marque que vous cherchez	3	13	6
La proximité du domicile	74	3	-
La diversité des produits proposés	2	7	8
Le prix	4	1	-
L'assurance sécurité d'hygiène	6	16	17
La confiance envers le marchand	5	25	20
La réputation du lieu	1	2	3
Possibilités de crédit	5	7	-
N'ont pas répondu	0	26	46

Tableau 12. Déterminants du choix du produit (% ménages) (Source: Nos calculs partir des données de l enquête)

	1er critère	2ème critère	3ème critère
L'apparence du produit	5	2	-
La confiance dans la marque	49	19	-
Le prix	5	2	-
La confiance envers le marchand	17	25	5
La confiance du lieu	7	8	6
La publicité	1	3	1
La date limite de consommation	16	18	18
N'ont pas répondu	0	23	70

Les déterminants du choix l'achat des produits laitiers sont identiques d'une catégorie socioprofessionnelle l'autre. L indicateur recherché au moment de l'achat est assurée en premier lieu par la confiance dans la marque, puis du marchand. Seule la catégorie des ouvriers fait aussi bien confiance au marchand qu' la date de péremption (21% des réponses pour chaque critère), tandis que les non déclarés font davantage confiance la date de péremption avant la confiance envers le marchand (22% des réponses contre 20%). Ceci est surtout lié au fait que cette catégorie comprend une proportion non négligeable de personnes illettrées.

Bien que l'offre, les choix et le souci de sécurité des produits laitiers soient augmentés ces dernières années en Tunisie, leurs prix semblent présenter un frein leur consommation. En effet, une part importante de consommateurs jugent très chers, même trop chers, et incroyablement chers le lait et les produits laitiers surtout le fromage (Tableau 13).

Si le lait est majoritairement estimé ni trop cher ni bon marché dans les catégories des patrons de l'industrie et du commerce, des professions libérales et cadres supérieures, en revanche, dans les autres catégories, les moins aisées, on le juge très cher, voir incroyablement cher.

Concernant les prix des yaourts et du fromage, les consommateurs estiment ces produits plus chers que le lait, même par les classes aisées. 38% des ménages de la catégorie des patrons de l'industrie et du commerce avouent considérer les yaourts comme des produits extrêmement chers ou des produits de luxe, incroyablement chers. Pour le fromage, 61% de cette catégorie estime son prix entre très cher et incroyablement cher.

Tableau 13. Niveaux de perception des prix des produits laitiers (% ménages) (Source: Nos calculs partir des données de l enquête)

	Lait	Yaourt	Fromage
Ne sait pas	0	1	6
Extrêmement bon marché	1	1	1
Très bon marché	4	3	2
Moyennement bon marché	5	5	4
Ni cher, ni bon marché	31	27	15
Un peu cher	4	8	5
Très cher	14	13	9
Extrêmement cher	20	19	16
Luxe, incroyablement cher	21	23	42

Conclusion

Les résultats de l'enquête sur les habitudes de consommation des produits laitiers révèlent que quelque soit la catégorie professionnelle des chefs de famille, les produits laitiers les plus achetés sont principalement le lait industriel UHT et les yaourts. Alors que le beurre, le fromage fondu de type portions et la rigotte viennent en deuxième position.

Les produits traditionnels semblent de moins en moins consommés Tunis. La crème fra che, les desserts lactés ainsi que de nombreux fromages, récemment introduits dans la gastronomie tunisienne, restent encore très faiblement consommés.

L extension de la grande distribution semble ne pas changer les habitudes d approvisionnement des ménages. La quasi-totalité des ménages, achètent le lait et les produits laitiers l épicerie. Dans certains quartiers, la p tisserie est une nouvelle forme de distribution qui se développe de plus en plus. Le colportage est encore présent.

La proximité du domicile et la confiance envers le marchand sont les premiers critères de sélection du lieu d'approvisionnement et expliquent le choix de l'épicerie pour l'achat des produits laitiers, lieu de distribution le plus répandu Tunis.

Une plus grande diversification des produits laitiers et en quantités plus élevées est observée dans les cités les plus aisés. Pour tous les produits laitiers, une proportion de ménages qui en achètent augmente avec le nombre d'enfants mais que les quantités achetées augmentent inversement au nombre d enfants.

uelques soient la classe sociale et le lieu de résidence, le lait et les yaourts s'achètent quotidiennement pour ne pas être stockés.

Le consommateur de la ville de Tunis est demandeur de produits laitiers de qualité et est sensible aux risques de mauvaises conservations et d'hygiène ou parfois de certaines fraudes. Les consommateurs se méfient encore des normes de conservation et de sécurité entreprises par les fabricants ou respectées par les commer ants au moment de la distribution. Ils se rassurent travers certaines marques qu'ils connaissent ou travers la confiance qu'ils ont envers le marchand du quartier.

Ces résultats montrent l'existence Tunis d'une demande potentielle en lait et surtout en produits laitiers qu'il est possible de satisfaire gr ce l'augmentation des disponibilités par personne, travers l'accroissement de la production locale et surtout la ma trise des co ts de production étant donné que les prix constituent la principale contrainte la consommation. Une plus grande préoccupation des politiques renforcer les normes de sécurité et de qualité qui pourraient jouer un r le important sur l'accroissement de la demande en ces produits afin de répondre aux attentes des consommateurs.

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Les changements dans la structure de la filière de la viande face à la qualité

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RÉSUMÉ – La filière de la viande bovine a été l'objet ces dernières années d'une crise profonde dérivant soit de tendances de longue durée concernant le changement dans les modes de consommation, avec une attention croissante au lien entre l'alimentation et la santé et donc une pénalisation conséquente pour la viande, soit d'évènements imprévisibles comme une série de scandales alimentaires. Pour freiner cette tendance, récupérer la confiance du consommateur et augmenter en même temps les potentiels de succès dans un marché toujours plus concurrentiel et global, un intérêt progressif vis à vis de la qualité s'est produit au sein de la filière. Face à une telle situation, le rapport suivant essaie de mettre en évidence la façon selon laquelle les entreprises peuvent entreprendre un parcours de qualité et montrer les modalités de passage d'une stratégie individuelle à une stratégie collective, exigeant la participation de tous les acteurs de la filière, dans une logique de qualification du produit/processus réalisé.

Mots-clés : Qualité, filière de la viande, certification.

SUMMARY – "Changes in the structure of the meat sector concerning quality". Over the last few years, the beef chain underwent a serious crisis, due to long-term trends in new consumers' habits, with consumers' becoming more and more interested in the connection between health and diet, which was detrimental to the meat industry, and due to unexpected events, such as a number of scandals that took place in the food industry. To curb this trend and recover the consumers' confidence and to increase at the same time the potential success of beef in an increasingly competitive and global market, the beef chain has become keener and keener on quality. In such a scenario, this report tries to highlight how the industry can start up a quality chain and to show the methods for moving from an individual strategy to a collective strategy, which requires the involvement of all the stakeholders of the chain, with a view to qualifying the final product/process.

Keywords: Quality, beef chain, certification.

Introduction

Aujourd'hui, le secteur zootechnique impliqué dans la production de la viande bovine se trouve, comme les autres secteurs économiques, face à une réalité en mutation totale dans laquelle : le consommateur est plus exigeant et attentif à la qualité du produit qu'il achète, la réglementation nationale et européenne est toujours plus pressante, le progrès technologique se développe rapidement et le niveau d'ouverture du marché est toujours plus ample. Dans ce nouveau contexte, l'avenir et le développement de l'entreprise zootechnique productrice de viande s'impose comme une nécessité. L'objectif de cette entreprise n'est plus seulement de savoir comment produire dans des conditions techniques et financières adéquates, mais de savoir quoi produire en réponse aux stimulations provenant du milieu externe. L'approche de la qualité devient, en même temps, un facteur stratégique et concurrentiel, un instrument avec lequel gérer l'entreprise et ses relations internes et externes à la filière. L'objectif de la relation suivante est donc celui d'analyser : (i) les changements que les entreprises zootechniques doivent réaliser pour entreprendre une stratégie de qualité ; (ii) les effets de ces changements, en termes de potentiel à exploiter et de criticité à surmonter sur les différents acteurs de la filière de la viande ; et (iii) quel rôle assument les institutions dans ce parcours de certification de la qualité.

Les adaptations des entreprises en réponse à un parcours de qualité

La politique de qualité dans la filière de la viande bovine a subi au fil des ans une évolution

remarquable caractérisée par une utilisation combinée de normes coercitives et d éléments volontaires (ISMEA, 2004). Les premières, finalisées la réalisation du marché unique, sont appliquées pour établir des conditions de compétitivité égale des productions au sein de chaque état membre et donner les garanties nécessaires pour la santé du consommateur.

Les instruments volontaires de la politique communautaire comptent sur la partie de la filière liée des formes traditionnelles et basée sur des races locales ou répondant des techniques productives en harmonie avec les exigences de protection de l environnement et les demandes de garantie du consommateur. Ils permettent d améliorer la capacité compétitive des entreprises en consentant ces dernières d atteindre et de maintenir certains niveaux de qualité, dans leur fa on de produire et/ou dans leur produit viande.

C est l adoption de ces instruments qui prévoit le passage d une politique correctrice basée sur le respect de normes établies par la loi (sans lesquelles il est impossible de commercialiser le produit – on parle en fait de qualité réglementée obligatoire) une politique de proposition dans une logique consumer oriented.

Il existe de nos jours deux instruments, réglementés par des règles coercitives et reconnues au niveau européen, utiliser dans la filière de la viande bovine en réponse aux exigences de typicité et de tradition ainsi qu la demande de protection de l environnement.

Dans le premier cas, nous avons (par le règlement 2081/92) deux types de certification concernant les dénominations d origine (dénominations d origine protégée – DOP, et indications géographiques protégées – IGP) qui garantissent (gr ce la préparation d un cahier des charges de production et une activité de contr le, effectuée par des organismes de certification privés de la part d une tierce partie, correspondants aux qualités requises imposées par la norme EN 45011) la provenance de la viande (Georgofili, 1998).

Dans le deuxième cas, on introduit (par le règlement 1804/99 et les modifications successives) la certification biologique conférée un produit viande dont la qualité, considérée conforme des techniques productives en harmonie avec les exigences de protection de l environnement et avec les demandes de garantie du consommateur, est assurée sur le marché gr ce la présence d un système de contr le constitué par des autorités de contr le désignées et/ou par des organismes de certification privés reconnus, répondant aux qualités requises par la norme EN 45011.

L emploi de dénominations communautaires comme DOP et IGP, est une stratégie de tutelle et de valorisation importante pour la filière de la viande bovine puisque, dans de nombreux secteurs, elle représente l unique politique de valorisation réalisable (Miele et Parisi, 2000). En effet, les dimensions économiques et productrices de beaucoup d entreprises opérant dans certains territoires de l UE ne permettent pas le recours des politiques de développement comme celles basées sur de grosses marques privées ou sur d efficaces labels-ombrelle, parce qu elles sont trop lourdes en termes de ressources humaines et économiques. En d autres termes, ces instruments peuvent être utiles pour transporter les petites et moyennes entreprises productives d origine et de typicité dans la compétition européenne, en valorisant les choix au point de vue de l organisation du processus productif et d image du produit (Berni et Bergalli, 1996).

Le service de protection de la qualité de l environnement, lié la certification de la viande biologique, constitue, en même temps, une caractéristique de la production, considérée comme processus et non pas seulement comme produit, qui s harmonise bien avec les tendances culturelles actuelles et les exigences socio-économiques.

Ses éléments de force reposent sur une attention renouvelée envers les équilibres sociologiques et environnementaux : le respect de la nature, la proposition répétée de valeurs liées l aspect rural, une attention majeure pour les aspects de la nutrition sur la santé. En outre, le contexte économique détermine des opportunités qui peuvent être cueillies gr ce la contribution de la viande biologique, la diversification de l offre et l affirmation d une technique qui s appuie sur une sustentation plus marquée du point de vue de l emploi et du maintien de la population rurale.

La certification, au moyen des trois instruments communautaires de reconnaissance de la qualité (DOP, IGP, biologique) tend créer en zootechnie des conditions de dépassement de l homogénéité

apparente des produits et de la concurrence parfaite, pour arriver la création d une concurrence monopolistique. Si d un c té, cette transition génère de nouvelles opportunités de bénéfices pour le producteur, de l autre, elle rappelle la nécessité de démarrer une gestion de l information, liée aux instruments de reconnaissance du produit offert. En opérant dans cette direction, les signes distinctifs communautaires deviennent une garantie de qualité de la viande produite, offrant l entreprise qui les utilise des opportunités de communication avec le consommateur et les autres sujets qui opèrent dans la filière. En d autre termes, la certification au moyen d instruments communautaires de reconnaissance représente une stratégie d entreprise utile non seulement pour différencier les productions, mais également pour rendre le marché plus transparent (dissymétrie informative) et développer des politiques de communication de type collectif.

bstacles et potentialit pour la croissance des viandes de ualit

Le développement d un parcours de qualité au sein de la filière de la viande bovine présente une certaine criticité et des points de force liés trois typologies d aspects : aspects productifs, aspects de marché et aspects gestionnaires.

En ce qui concerne les aspects productifs, créer un parcours de qualité de la viande comporte non seulement une gestion compliquée des processus productifs, mais aussi la nécessité d une intégration majeure parmi les différents sujets de la filière, capable d assurer un rapport adéquat entre la demande et l offre. ces éléments s ajoutent aussi des co ts majeurs de production au niveau des entreprises. Parmi ces co ts, il y a des co ts pour l implémentation et la gestion successive de l activité d autocontr le (y compris ceux relatifs aux contr les analytiques sur le produit fini) et des co ts pour l activité de certification de la part de tiers organismes. Les entreprises avec un système de co ts moins élevé, une plus grande flexibilité de ressources et des contraintes financières moindres, peuvent, en cas de chute de la demande, rester sur le marché en supportant une réduction des prix de la viande offerte. Au contraire, les entreprises qui travaillent avec des marges plus basses, sont obligées, face une telle situation, de sortir des logiques commerciales définies par une politique de label.

Par référence au marché, s il est vrai que la viande de qualité est l objet d une attention croissante de la part des segments plus évolués des consommateurs, il est également vrai que ce segment de la demande revêt encore un r le marginal dans le domaine de la consommation globale de viande bovine (Becker, 2000). En effet, la demande pour les productions de qualité est liée surtout la disponibilité d un revenu élevé et se présente souvent fortement localisée, parce qu elle est également liée, de la part des consommateurs, une culture spécifique de la viande, qui dans de nombreux cas puisent ses origines dans les traditions de consommation.

De plus, pour les productions de qualité, les aspects liés un système adéquat de distribution sont particulièrement importants. En effet, si les filières plus modernes et organisées apparaissent aujourd hui peu idoines ces productions, l utilisation de filières plus traditionnelles et surtout plus courtes, peut être considérée comme un facteur valable de développement.

En ce qui concerne la vente de la viande de qualité, il est donc utile d éliminer le plus possible les passages intermédiaires et privilégier le canal bref en insistant sur la compétence de la typologie de la marchandise, sur l image qualifiée et sur le rapport direct avec le client final. Ce canal peut offrir : une plus grande reconnaissance et information du produit, un contr le plus important sur la cha ne de valeur, une plus grande facilité pour trouver des cibles de consommation sensibles, de majeures possibilités d offrir une filière tracée, de plus grandes possibilités d insérer dans la valeur du produit des aspects immatériels.

Miser enfin sur un parcours de qualité permet de fixer sur le produit des prix plus élevés et d obtenir un avantage compétitif par rapport au productions indifférenciées.

D un point de vue gestionnaire, si une stratégie de qualité est liée un intérêt de la part des différents sujets institutionnels qui fournissent des incitations, elle peut parfois présenter une criticité marquée du point de vue bureaucratique en phase de reconnaissance de certification. En outre, la création d un système de contr le rigide garantissant l image du label pourrait faire na tre des conflits au sein des producteurs et entre ces producteurs et l organisme gérant qui utiliserait des procédures

et des instruments pouvant compliquer, au lieu d aider, la vie bureaucratique et administrative des entreprises. La création d un plan d assurance qualité dans la filière de la viande bovine qui soit efficace et efficient, demande un investissement en formation, afin de développer les compétences nécessaires pour affronter la gestion de ce système.

Le r le des institutions concern es par le processus de certification

Les institutions qui tutèlent les viandes de qualité sont directement concernées par le processus de certification, se rangeant aux c tés du producteur et de l organisme de certification.

Le producteur a le devoir d effectuer les contr les sur les processus et les produits d entreprise (activité d autocontr le). Afin de démontrer la véridicité de ce que le producteur veut déclarer au client en relation l objet de la transaction, l organisme de certification doit veiller sur les systèmes de contr le de l entreprise et garantir, par un acte de certification erga omnes, que les systèmes d autocontr le soient soignés et efficaces enfin le troisième sujet, représenté par le sujet institutionnel doit veiller sur les organismes de certification en garantissant leur objectivité, leur compétence et leur transparence.

A ce jour, le sujet institutionnel indique de quelle fa on le système de certification est organisé. Un système de certification doit prévoir : l identification des qualités requises l émission de normes convenues entre les parties en cause, relatives aux qualités requises une méthode pour évaluer les qualités requises un ensemble de règles de fonctionnement de l organisme de certification les qualités requises pour le personnel opérant au sein du système.

Ce système est donc basé sur une série de principes fondamentaux :

(i) Le système doit être contrôlable. Le système de certification reproduit sur une échelle toujours plus ample le concept de contr le. L entreprise doit exercer un autocontr le, l organisme de certification contr le le système de contr le de l entreprise, enfin, l organisme d accréditation, sujet institutionnel, contr le le système de certification, en effectuant le contr le du contr le d un contr le.

(ii) La séparation des rôles. ui certifie, ne peut pas co ncider avec qui est certifié et avec qui accrédite. son tour, celui-ci doit être différent de celui qui certifie. Il est donc nécessaire de maintenir une nette séparation fonctionnelle entre ces trois r les mais il faut, en même temps, établir un certain dialogue entre les parties, car toutes les trois contribuent l obtention du produit/processus.

(iii) La standardisation des méthodes. La standardisation des méthodes par laquelle certaines fonctions sont mises en uvre (autogestion, vérifications d inspection, activité de vigilance) devient non seulement un instrument pour garantir l impartialité des résultats obtenus, mais représente un élément essentiel de communication entre les parties.

(iv) La présence d'une activité de vérification interne. Tous les sujets engagés dans le système doivent réaliser une activité de vérification interne (autocontr le pour les entreprises, vérifications d inspection internes pour l organisme de certification et l organisme d accréditation).

Le sujet institutionnel introduit le concept de garantie travers deux fonctions distinctes une fonction de contr le et une fonction de certification. La fonction de contr le effectuée par le producteur a pour devoir de tenir sous contr le, en se basant sur la logique de l assurance qualité, le processus et par conséquent le produit, en garantissant les qualités requises établies par la réglementation de référence. La fonction de certification effectuée par un organisme indépendant et surtout tiers par rapport celui qui produit, atteste de fa on impartiale la correspondance du produit. Cette certification assure donc l utilisateur que le processus/produit est conforme aux qualités requises établies et maintenu sous contr le par celui qui produit de fa on systématique.

Consid rations conclusives

Selon ce qui a été dit précédemment, il résulte que s approcher de la qualité du produit et du

processus, représente pour les entreprises de la filière de la viande bovine la possibilité d augmenter leur potentiel de succès sur le marché. Il est évident que, avec différentes modalités, les entreprises zootechniques productrices de viande qui misent sur la qualité, doivent opérer afin que les instruments adoptés deviennent non seulement un moyen avec lequel identifier le produit/ processus mais soient capables de remplir leur fonction de garantie, auprès du consommateur.

A ce propos, il est fondamental d utiliser les stratégies les plus idoines pour différencier et promouvoir le produit offert afin que le consommateur possède tous les instruments pour distinguer la viande qu il veut acheter et que le producteur soit capable de fournir une image adéquate du produit offert, en orientant le marché.

Il est toutefois nécessaire de préciser que ces instruments sont fondamentaux non seulement pour réduire la dissymétrie informative présente sur le marché et conquérir le client final, en proposant un produit viande avec de plus hauts niveaux de garantie, mais parce qu ils représentent également un moment de croissance pour tous les sujets de la filière engagés dans leur implémentation et gestion successive.

Adopter ces instruments, signifie en effet : respecter ce qui est défini au sein de chaque instrument responsabiliser tous les sujets engagés dans leurs activités de compétence afin d atteindre les objectifs fixés acquérir, de la part des différents sujets qui interviennent dans la phase d implémentation et de gestion de l instrument, certaines connaissances techniques et directoriales.

La croissante orientation de la demande vers le segment des productions de qualité peut donc constituer une occasion importante pour le monde de la production afin de redéfinir, partir d une position privilégiée, les rapports avec les différents opérateurs de la filière et réussir commercialiser directement sur le marché de la consommation, en se réappropriant de la relative valeur ajoutée.

En même temps, la capacité pour les entreprises de certifier leurs productions et la possibilité de compter sur des organismes idoines capables de le faire, vont devenir un élément stratégique important. Il faut toutefois préciser qu aucune activité de certification de la part de tiers sujets, ne peut substituer l activité d autocontr le effectuée par le producteur.

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Organisation of the beef cattle sector in the Autonomous Community of the Basque Country (Spain)

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SUMMARY – The beef cattle sector has experienced significant changes in the Autonomous Community of the Basque Country (BC) since Spain joined the EU in 1986. Although its level of organisation is still lower in comparison to more traditional activities (dairy sheep and cattle), an important number of structures have been set up to work in favour of its development. On the base, there are Local Breeders Associations at the province level (Alava, Bizkaia and Gipuzkoa) for each of the main breeds raised, and the corresponding Management Centres (cooperatives that provide services to farmers and farmers associations), all of them keeping close links to the local administrations (Diputaciones Forales or County Councils). At the BC level, promoted from the Basque Government, there are agents providing services in R+D (Neiker); high-quality computer services (IKT); training and education (Itsasmendikoi); development and marketing of high-quality products (Kalitatea Foundation); genetics (Aberekin); food safety (Elika) and marketing (Gurokela).

Keywords: Beef, sector, development, structures, organisation.

RÉSUMÉ – *"Organisation du secteur de la viande bovine dans la communauté Autonome du Pays Basque (Espagne)" Le secteur bovin viande a connu une importante évolution au Pays Basque (PB) depuis l'entrée de l'Espagne dans l'UE en 1986. Bien que le niveau d'organisation soit encore faible en comparaison avec d'autres secteurs plus traditionnels (ovin et bovin laitiers), il y a aussi un nombre signficatif d'agents qui travaillent à son développement. À la base se trouvent les Associations Territoriales de Producteurs, une par province et race (Pirenaica, Limousin, Blonde d'Aquitaine, Charolais, Betizu, Terreña et Monchina), les Centres de Gestion (coopératives qui fournissent des services d'appui technique aux producteurs individuels et aux associations), et les Administrations Locales (Diputaciones Forales). Au niveau du PB, il y a aussi un certain nombre d'entreprises créées avec la collaboration du Gouvernement Basque qui travaillent en R+D (Neiker), des services informatiques de haute qualité (IKT), la formation technique (Itsasmendikoi), la qualité du produit (Fundación Kalitatea), l'amélioration génétique (Aberekin), la sécurité alimentaire (Elika) et la commercialisation (Gurokela).*

Mots-clés : *Bovin, allaitant, développement, organisation, structures.*

Introduction

The Autonomous Community of the Basque Country (BC) is located at the western end of the Pyrenees on the Bay of Biscay. There is an estimated population of just over 2.1 million for a total surface of 7,261 km^2, which means a high population density (300 inhabitants/km^2) mainly located on the valleys due to an abrupt and mountainous orography.

In 1981, when the Basque Government assumed competences in Agriculture and Livestock, the local primary sector consisted of a huge number of small-sized low-specialized family farms, deficient infrastructures, lack of organisations, and there was a significant incidence of pathological processes (tuberculosis, brucellosis, leucosis, etc.). Whereas the impending Spanish entry in the EU (which finally took place in 1986) offered an uncertain future for many farms, the fast development of industry and services meant a high demand of labour and interesting salaries, making more difficult the consolidation of a solid agriculture. However, the sector was considered of strategic importance and it begun a process to establish the organizational basis (Urarte *et al*., 1999) that could allow later adopting effective police measures in animal health, quality products, etc., aiming towards a more competitive and sustainable agriculture.

Nearly 25 years later, there are around 20,000 farms exclusively for agricultural purposes and

19,000 livestock or dual purpose (livestock + agriculture) farms. They are responsible for the management of 82% of the territory and create around 21,500 full-time jobs, 2.1% of total labour (Eustat, 2005). In 2003 the primary sector supplied 514 million €, livestock contributing with 39%, agriculture with 45%, and forestry with 14%. Although the total figure just means around 1% of the Basque Gross Domestic Product, there is a complex set of agents providing a wide range of services to a decreasing but much more specialized number of farmers in nearly every sector.

Development structures in beef cattle

Whereas dairy cattle and Latxa dairy sheep have traditionally played leading roles in livestock rearing, other activities such as beef cattle, goats, horses, etc. have been relegated to a secondary status. During the last decade the production of beef cattle has experienced a significant growth: whereas in 1990 there were 29,758 suckling cows, in 2005 they were 59,166. Nowadays, beef meat accounts for 24% of livestock gross production. Most animals are crossbreds, mainly with Holstein, but there are increasing populations of purebreds Pirenaica, Limousín and Blonde d'Aquitaine. The fact that beef cattle rearing can be a complement to other economical activities, either agricultural (dairy, cereal, etc.) or out of the farm (industry), has arisen increasing interest among farmers and the sector has behaved in a quite dynamic way. Next, a description of the main actors working in favour of this activity will be presented (Fig. 1).

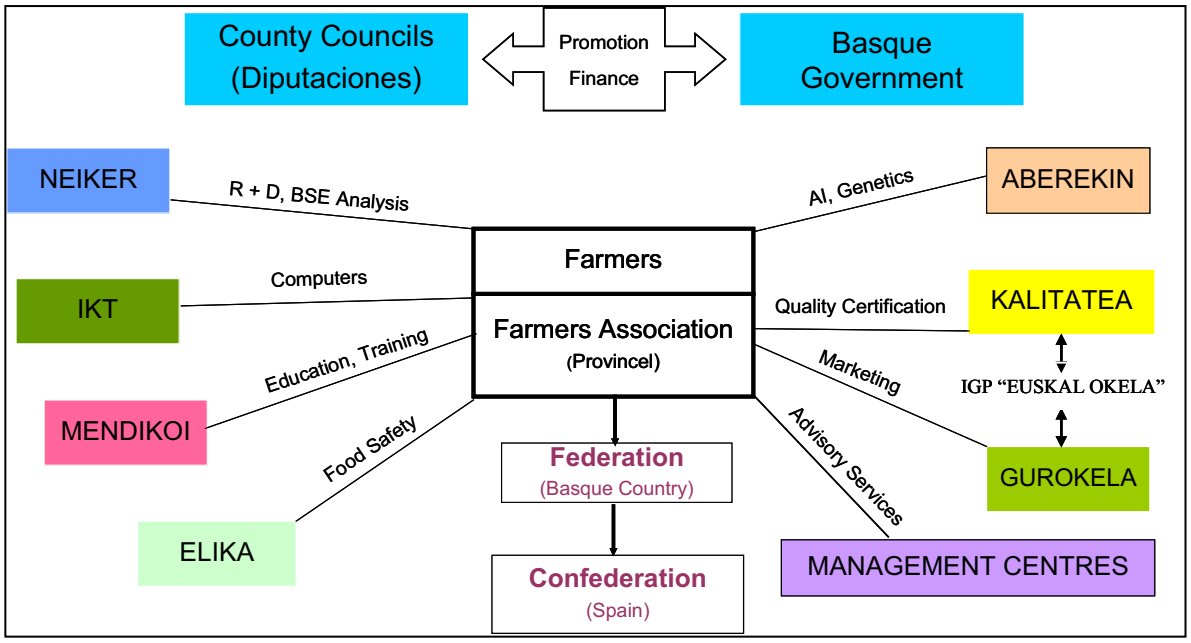

Fig. 1. Organisation of the beef cattle sector and development structures existing in the Autonomous Community of the Basque Country.

Beef cattle breeders' associations

The base of the sector is formed by the 5967 farmers (Eustat, 2005) nowadays existing in the BC (2952 having more than 4 heads), but specially those ones taking part of the beef cattle breeders' associations formally set up. In this sense, three organizational levels can be observed: (i) Province (Alava, Bizkaia or Gipuzkoa): breeders' associations; (ii) Autonomous Community of the BC: Federations; or (iii) State (Spain): Confederations. At the province level, there are 15 Farmers' Associations around the main pure breeds: Pirenaica, Limousin, Blonde, Charolais, Betizu, Terreña and Monchina. They encompass 559 farmers (Table 1), and are responsible for data collection, management of recording programmes, data processing and management of Herd Books. On average, the local administration provides 65% of the cost of the different programmes carried out, the rest being supported by farmers.

Table 1. Total number of farms and census registered in the breeders associations (2004)

	Pirenaica	Limousin	Blonde	Charolais	Terreña and Betizu
No. of farms	231	219	68	28	13
No. of females					
Cows (> 24 months)	3957	3456	812	397	221
Heifers (12-24 months)	2042	1416	330	252	503
Calves (< 12 months)	1373	1185	307	147	102
Males					
Bulls (> 16 months)	1272	1169	323	153	90
Young (< 16 months)	355	304	76	55	71

The most important one in terms of number of animals inscribed, years of experience in conservation and genetic improvement is the Association of Pirenaica, the only autochthonous cattle breed reared in commercial flocks with productive purposes, whose Genealogic Book begun in 1988. The genetic programme is carried out together between BC and Navarre upon the following characters: live weight at birth and at 210 days-old. Genetic evaluations are done with a BLUP methodology including an animal model with repeatability and mother effect, in the Faculty of Veterinary, University of Zaragoza.

The Association of Limousin was sorted following the same scheme and methodology of Pirenaica's. The Basque Association takes part of the national breeding programme and evaluations are carried out simultaneously for the whole Spanish population by INIA (Spanish National Institute of Agricultural Research and Technology). Since 1987 there is a National Genealogic Book managed by farmers under the control of the Ministerio de Agricultura, Pesca y Alimentación. The Blonde d'Aquitaine breed (Federation sorted in 1996) has recently been recognised and the national confederation is trying to set the bases for a national breeding programme following the criteria applied in France for beef cattle.

As for autochthonous breeds, to attempt to increase the scarce populations of Terreña, Betizu and specially Monchina, they receive economical support within the package of the existing environmental measures. Although Euskal Abereak is the association that works in favour of their conservation in general terms (sheep, cattle, poultry, etc.), specific associations have been formed to work more specifically with Terreña and Betizu breeds not only with conservation purposes, but taking into account productive objectives as well, so as in the future they could be economically profitable.

Provincial Breeders' Associations formed at the province level for a particular breed are joined together in a Federation for the entire BC. The role of the Federation is to coordinate the Recording Programmes in the three territories, put the data together and elaborate the database in the suitable format that will later be sent to the following level. National Confederations are responsible for collecting these databases from the different Autonomous Communities existing in Spain in a way that genetic evaluations can be carried out together.

Management Centres

Instead of setting different structures per activity or sector, the Management Centres (Centros de Gestión) are co-operative societies of agricultural and livestock services (Jauregi, 2004; Ruiz and Ugarte, 2004). They are small enterprises that have the resources (staff, instalments, computers, facilities, etc.) required to provide individual farmers, agricultural cooperatives or Farmers' Associations with efficient services within a particular province. They have normally been formed as cooperatives, with the different types of farmers' associations acting as members. This sort of organisation allows optimising the utilisation of resources, minimising costs, a better specialization of professionals, and in consequence, an efficient activity. They provide technical (nutrition, reproduction, grasslands, accountability, etc.) and economical advisory. Management Centres have played a determinant role in the development of the agricultural sector in the BC as they have been

responsible for carrying out directly a wide range of programmes, maintaining at the same time a direct relationship with both farmers and the Administration. As a consequence, they have gathered an important volume of data and expertise since they were first established (Lurgintza in 1960; Lorra in 1986; Sergal in 1994, and Abelur in 2005), and they really have a very deep knowledge of every agricultural activity.

Development structures

In order to cover some of the needs arisen from the agricultural activity and give answers to the requirements observed, several enterprises, development agents or support structures have been set as the time passed by. Most of them make use of public funds to provide the sector with very specialized services, which sometimes are also offered to other autonomous communities by means of specific agreements. In many cases, they provide crucial tools for the development of projects.

NEIKER, the Basque Institute for Agricultural Research and Development, is a non-profit making Public Company under private law, owned by the Basque Government and attached to the Department of Agriculture, Fisheries and Food of the Basque Government (DAPA) (see Neiker, 2005). It was settled in 1998 with no lucrative purposes coming from the two public centres of R+D existing previously. Its objective is to carry out R+D projects and highly specialized services in terms of laboratory analysis and diagnosis for the local primary sector and the existing agro-food industry. As a sample, regarding beef cattle R+D projects have been carried out about genetic evaluations of sires for Aberekin; calving ease; livestock farming systems identification; characterisation of beef growth curves; grazing behaviour, habitat and diet selection in mountain pastures; animal performances; development of decision support systems for ruminants management, etc.

However, the control of Bovine Spongiform Encephalopathy (BSE) has been one of the most important activities carried out following the outburst that shocked the sector during the 90's. In 1996 the Basque Government and the County Councils (Diputaciones Forales) designed a Plan for the Prevention, Vigilance and Control of BSE. Since 1994 feeds containing animal protein by-products cannot be fed to ruminants, being foodstuff processing plants and livestock farms regularly controlled. Since 2001 every animal slaughtered ageing over 24 months-old is analysed for BSE detection test in the P3 Laboratories of Neiker-Derio, results are obtained in 24 hours and, if positive, the carcass will be removed from the food supply chain. Anyway, animals must be slaughtered in allowed instalments and specific risk materials must be removed from the carcass (Order 218/2000, 7th of November). As for labelling, since the 1st of January of 2002, it is compulsory to include two new pieces of information: (i) country where the animal was born; and (ii) country (or countries) where the animal was raised. According to the Order 235/2000, any sort of information that cannot be controlled, proved or could induce to misunderstanding or confusion within the consumer is absolutely forbidden. The objectives are: (i) that according to the current knowledge, every beef meat product goes through very strict controls, even above those legally required, before arriving to consumers; and (ii) to provide consumers with all the information to which they have a right of access.

Precisely ELIKA (see Fundación ELIKA para la Seguridad Agroalimentaria, 2005) is a foundation created in January 2001 as an initiative of the DAPA after the outburst of BSE and is engaged in the area of food safety with an integrated, preventive and quick response approach. Initially ELIKA was in charged of risks assessment and alert management in relation to the primary sector and the Basque agro-food industry, and later have been promoting the preparation of a set of Good Practice Guidelines for the primary sector to identify potential hazards.

Aberekin (1985) is an artificial insemination unit sorted by and to the service of farmers that test every year more than 50 dairy and beef bulls (see Aberekin SA, 2005). They have two units of production with capacity for 300 bulls. Together with Holstein sires, they also keep males of Pirenaica, Limousin, Blonde d'Aquitaine, Charolais, Belgian Blue, Brown-Swiss, Salers, Fleckvieh and Normande breeds. The production process of seminal doses is certified in agreement to the ISO 9001/2000 norm. The quality achieved and strict health politics applied has allowed that 42 countries are using these genetics.

IKT SA (founded in 1989) is an engineering and consultant company promoted by the DAPA and the County Councils as well as the co-operative societies of agricultural and livestock services

previously mentioned (see IKT SA, 2005). IKT SA aims to satisfy their clients and partners through a more efficient and professional management, continual adaptation to technological change and optimum use of resources. They have played a leading role in the design, implementation, coordination and maintenance of technical services, mainly in computers, for the primary sector.

Finally, ITSASMENDIKOI can be defined as the Integral Centre existing in the BC for Education, Promotion and Rural Development following the policies and strategies established by the DAPA (see Itsasmendikoi, 2005). By means of establishing narrow links with every agent involved in the primary sector, the main objectives are to collaborate in the modernisation and professionalisation of agriculture activities, the restoration of standard of living conditions of rural population in similar terms to those in urban areas, and the maintenance of cultural heritage and traditions.

Marketing and commercialisation structures

Initially, the joint purchase of foodstuffs, fertilisers, phytosanitaries, seeds, farming implements, etc., was promoted by means of cooperatives (MIBA, ANOGA, etc.) or management centres.

Then KALITATEA Foundation (see Fundación Kalitatea, 2005) was set up in 1998 by the Agricultural Department of the Basque Government as a non profit making organisation, aiming to encourage, promote and develop quality food products. It is basically a control and certification agency. Nowadays there are 17 products with the "Eusko Label" of quality, controlled by a particular Technical Regulation and periodically controlled: 5 vegetables, 4 wines, 3 meat products, 2 fish products, 2 dairy products and honey.

As for beef meat, Euskal Okela is the beef certified with the *Eusko Label - Kalitatea* mark, which complies with all requirements regarding origin, health and quality defined in the technical regulations that control this product. It comes exclusively from animals born and raised on farms in the Basque Country, controlled at all stages of their development and selected according to their quality in authorised abattoirs of the Basque Country. It is sold exclusively in authorised butcheries, easily recognisable by a particular symbol. Every time consumers purchase Euskal Okela meat, butchers provide them with an adhesive label printed on special scales, indicating all the details of the operation and with the logo. Therefore, the Kalitatea Foundation guarantees the origin of animals, above-average quality, additional health guarantees and product authenticity.

A similar label (GIOKELA) was created in Gipuzkoa by a group of farmers that certifies that animals are raised and slaughtered in the Basque Country, but not necessarily being born there.

Except in dairy cattle, where KAIKU Coop. has been crucial for the development of the sector, nearly nothing has been done in relation to joint commercialisation in the remaining livestock sectors. Several explanations can help to explain this fact. First, the Basque market of foodstuffs is deficient in nearly absolutely every product. Then, in addition to a high population density, the prestige of particular products and transformers, valuation of know-how practice, celebration of weekly rural markets, and the chances for a mutual knowledge producer-consumer, etc., account for a high fidelity in the purchase of some products (cheese, vegetables, etc.)

But selling meat products has usually become much more complex. To try to offer a solution to the sector, the DAPA has recently (2004) promoted the creation of Gurokela SL by 254 farmers, who represented 15,000 cattle, 30% of the Basque census, 15% of total meat production and 30% of the "Euskal Okela" total sales volume. Gurokela aims to improve the competitiveness of local farms by means of better production strategies and commercialisation of high quality products. To do so, they will try concentrating the existing offer, reducing operating costs at slaughtering and quartering, and selling within the Eusko Label Regulation, but also trying to adapt better to the new purchase tendencies (formats, habits, etc.). Gurokela considers that these strategies will bring a better situation for negotiation and higher margins. They are opened for members, and would welcome local administrations, banks and distribution agents, regarding farmers keeps at least 51% of the capital.

However, Gurokela has shocked the local sector, already in a weak situation due to the predominant existing structures (scattered sector, small sized farms, decreasing margins, etc.), and has caused unrest within certain farmers and butchers. Specially, some recent measures (such as the

privatization of the management of the slaughterhouse of Bilbao, closing those of Durango and Vitoria, etc.) have been very controversial. Farmers' Unions had already showed their mistrust in this initiative and consider that such concentration will decrease the chances for commercialisation specially for small producers and will damage their sustainability in the medium term.

In conclusion, although it is commonly agreed that the beef cattle sector shows a great deal of constraints in the BC, at the same time there seems to be the tools and actors required to face them and even to afford making profit from the opportunities that can be envisaged for the future.

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L'approvisionnement du grand Beyrouth en viande bovine : Fonctionnement, contraintes et perspectives

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RESUME – La filière de la viande bovine au Liban est marquée par le retrait total de l'Etat et la prise en mains de toutes les formes d'organisations, par des acteurs privés. La libre confrontation de l'offre et de la demande, dans les conditions d'une économie ouverte, constitue le principal axe sur lequel est basé l'évolution du secteur. Etant une des premières études réalisées sur le sujet et confrontée à l'absence des données statistiques régulières et fiables, ce travail s'inscrit dans une approche qualitative en s'intéressant surtout à l'examen de l'interaction entre logiques des acteurs et structures de marché. Cette approche est basée notamment sur les résultats des enquêtes réalisées auprès des chevillards qui opèrent dans le Grand Beyrouth. L'objectif du présent travail est de montrer l'intérêt et la nécessité pour la municipalité du grand Beyrouth de mettre en place des mesures visant à garantir l'approvisionnement.

Mots-clés : Approvisionnement, distribution alimentaire, Liban, Grand Beyrouth, bétails, viande rouge, stratégie des acteurs, chevillards, abattoir.

SUMMARY – *"Supply of beef to Beirut: Performance, constraints and perspectives". The present study examines the marketing of beef and veal in Lebanon which is marked by the total absence of state control. It is a sector which is left in the hands of all sorts of organisations and private dealers. The free confrontation of supply and demand, under the terms of open and free economy, constitutes the core on which the growth of the beef and veal sector is based. This study is one of the first to be carried out on the subject. In the process of undertaking this research, this study was faced with serious challenges with regard to reliable statistical data which was either lacking or unreliable. This research adopts a qualitative approach focusing particularly on the study of the correlation between the dealers' strategies and the current market structures. This study is based in particular on the findings of the investigations carried out near the "chevillards" (cattle market) which operates in Beirut. The aims of this study is to show the interest and the need for the municipality of Beirut to introduce a set of measures and rules in order to guarantee the meat supply on the basis of health and safety regulations.*

Keywords: *Supply, food distribution, Lebanon, Beirut, cattle, red meat, strategies of stakeholders, chevillards, slaughterhouse.*

Introduction- problématique

La situation indique qu'il y a une organisation de la filière vis-à-vis de la commercialisation. Une attitude, selon beaucoup d'auteurs dont Bourbouze (1995) cité in Khalil (1997), qui résulte des relations très fortes entre les producteurs et les autres intervenants.

Ces principaux opérateurs de la commercialisation sont en perpétuel contact (réseau informel). Toujours à l'écoute du marché, attentif à l'offre et à la demande, ils négocient leurs affaires sans intervention de l'Etat. Dans la présente étude, nous essayerons d'analyser la filière viande bovine, eu égard à la demande du gouvernorat du Grand Beyrouth qui a fait l'objet d'une étude dans la cadre d'une thèse Master of Sciences CIHEAM-IAMM en 2003. Nous accorderons une importance aux échanges du bétail sur pied émanant de l'importation, identifiant l'ensemble des opérateurs du circuit de commercialisation.

Le thème de cet article porte aussi sur la pertinence de la volonté politique et publique d'éliminer ce secteur dit "informel". Est-il un secteur bien différencié ? Favorise-t-il la sécurité alimentaire en assurant continuellement et complètement l'approvisionnement du Grand Beyrouth en viande bovine ?

Méthodologie

Nous considérons l'approvisionnement dans ses trois dimensions : (i) une disponibilité de produits dans le temps et dans l'espace ; (ii) des prix stables et attractifs ; et (iii) une certaine sécurité sanitaire (Padilla *et al*., 2004). Suite à la délimitation géographique de la zone d'étude, une série d'enquêtes a été réalisées dans le Grand Beyrouth[1] au cours de l'année 2002 et 2003. La zone correspond à la municipalité de Beyrouth et les régions de proximité qui sont approvisionnées (zone de commercialisation). Le questionnaire a porté sur l'identification de l'activité, la zone de production et les circuits de commercialisation et de l'approvisionnement. Une typologie des exploitations a été réalisée à la fin des entretiens.

Résultats et discussions

Une filière extravertie et une consommation de viande proche de la moyenne européenne

La demande libanaise porte essentiellement sur la viande de jeunes bovins ou de veau; une viande maigre, tendre et plutôt claire est prioritairement recherchée. Autour de 20 kg téc/habitant en 2002, la consommation de viande bovine est proche de la consommation moyenne de l'Union Européenne et des pays méditerranéens.

Alors qu'environ 37 000 têtes bovins produits localement sont abattus pour la boucherie pour l'année 2001-2002, faisant un total en viande de 7000 téc, cette quantité ne représente que 8% de la consommation annuelle du Liban en viande bovine (Institut de l'Elevage, 2002). En effet, l'étroitesse du pays et le caractère familial et traditionnel caractérisent l'élevage local, mettent le pays dans un état de dépendance avec des importations massives depuis des dizaines d'années. En effet, plus de 92% (80 500 tèc) des besoins de consommation en viande bovine de la population est importé, répartis en 7100 téc de viandes fraîche, à 60 000 tèc d'animaux vivants sur pied, et, environ 8216 tonnes de viandes congelées, le reste étant de la viande préparée et conservée estimée par nos calculs à environ 4000 téc.

L'importation de bovins vivants est très ancienne, et d'ailleurs traditionnelle dans les villes pourvues de port commercial (Saida, Tours, Tripoli, Beyrouth) ou frontalières (la Bekaa avec la Syrie par exemple), mais le plus fort développement a vu son virage durant les années de la guerre. D'après les douanes libanaises, les importations de bovins vifs destinés à l'abattage ont atteint un sommet en 2002, de plus de 227 982 têtes soit 60 000 téc. Les années précédentes, elles variaient entre 185 036 et 213 872 soit 50 et 56 000 téc (entre 1997-2001).

Les prix à l'arrivé au Liban s'établissent en moyenne à quelques 2 US $/kg équivalent carcasse sur l'année 2002. Les effets combinés de la très bonne tenue des cours du jeune bovin en Europe et de la baisse des taux de change du dollar US, non compensée par une hausse des restitutions européennes, aboutissent à une franche augmentations des prix à l'arrivé au port de Beyrouth, à 2,17 US $/kg équivalent carcasse au premier trimestre 2003.

Les types d'animaux fournis sont assez disparates (race lait, viande et mixte), même s'il s'agit presque toujours de males de moins de 300 kg (30 mois selon la législation libanaise). Les importateurs de bovins vifs, au nombre de neuf[2], recherchent sur un marché mondial des males assez lourds mais pas trop gras. Cette caractéristique permet un meilleur rendement à l'abattage et une meilleure résistance au long voyage maritime. Ce détail devenu trop difficile à réaliser à cause des prix élevés sur le marché, notamment celui de l'Europe, les importations en vifs sont de plus en

[1] Le Grand Beyrouth a une superficie de 1500 km^2, allant du "Nahr El Kaleb" au nord jusqu'à "Nahr El Damour" au Sud, et de "Jebel El Barouk" à l'est jusqu'à la mer méditerranée à l'ouest. Ces agglomérations constituent l'essentiel de l'environnement urbain du Grand Beyrouth et forment la véritable armature urbaine et rurale qui entoure celle de Beyrouth et la continue. Ces noyaux n'appartiennent pas tous aux gouvernorats du Grand Beyrouth, mais rayonnent tous autour de la capitale avec des fonctions et des attributs plus au moins homogènes. Sur le plan démographique, le taux d'accroissement annuel de la population totale est de 4,8%. La population dans le grand Beyrouth est évaluée à 2 millions habitants en 2003.

[2] Selon le Syndicat des marchands de bétails, la liste s'est réduite au nombre de 9 suite aux crises successives.

plus maigres. Cependant pour des raisons de prix, l'un des plus grands importateurs libanais[3] s'approvisionnait jusqu'à la mi-juin 2002 surtout de jeunes bovins français de race rustique (type Salers, Aubrac). Nos discussions avec les marchands de bétails, ainsi que les importateurs indiquent qu'il est désormais dans l'obligation de se tourner vers un marché plutôt maigre, même considéré de moindre qualité bouchère. Ainsi, on assiste à des importations de jeunes bovins brésiliens et même irlandais et les importations sont orientées de plus en plus vers la race Holstein.

Par ailleurs, il semblerait que la distribution et l'écoulement des carcasses plus légères soit plus facile notamment dans le grand Beyrouth. Selon le président du Syndicat de l'Union des Marchands de bétails et des bouchers, les races lourdes sont plutôt écoulées dans certaines régions (certains quartiers riches du Beyrouth et le nord du Liban). Selon l'Institut de l'Elevage (2003), l'allègement moyen des animaux expédiés de l'UE est pratiquement continu depuis 1995, passant de 610 kg (pour 110 000 animaux en 1995) à 542 kg (pour 200 000 animaux)[4]. En l'an 2002, les trois principaux fournisseurs européens, dans l'ordre l'Allemagne, France et Irlande, ont expédié à eux seuls 97% des jeunes bovins vers le Liban (Institut de l'Elevage, 2002) (Fig. 1).

Fig. 1. Principales sources d'importation du bétail vivant au Liban (1994-1996).

Aucun fournisseurs hors Union Européenne présents jusqu'à 2001 (Bulgarie, Roumanie, Turquie, Ukraine, etc.) n'a pu renouer avec ce marché en 2002. Cependant au premier trimestre 2003, les importations en vifs note un retour de l'Ukraine dans la liste des fournisseurs. Les prix élevés enregistrés dans l'union Européenne et la guerre de l'Irak, gênant le trafic maritime, sembleraient être les principales causes de cette nouvelle carte de fournisseurs.

Une filière en plein transition structurelle

Une ceinture d'exploitations d'élevage de boucherie s'est ancrée dans le Grand Beyrouth ; une mutation structurelle et spatiale qui s'est traduite par l'installation d'infrastructures, souvent hors sol appelées "mazraa"[5]. La nouvelle localisation géographique de la production a entraînée l'accroissement des quantités commercialisées. Les unités territoriales de production, nettement différenciées, constituent un espace de viande fortement polarisé autour de la capitale de Beyrouth. Son potentiel productif est de loin le plus important au Liban puisqu'il représente 40% de la production en viande bovine totale du Liban (Tableau 1) contre 20% pour le Sud du Liban, 15% respectivement dans le Nord et la Bekaa et 10% à Jebeil Loubenane .

Le Tableau 1 indique la répartition de l'abattage selon les régions constituant la ceinture d'abattage du grand Beyrouth.

L'abattage doit en principe être réalisé en abattoir public à caractère provisoire. Cependant, le dysfonctionnement (taxes élevées par rapport aux services offerts, manque de place, manque d'hygiène et de services, etc.) de l'abattoir et sa faible capacité à répondre à la demande du marché local, a engendré l'apparition et le développement spectaculaire d'abattoirs privés dans la périphérie

[3] Jusqu'à 50% de l'approvisionnement en vif en 2001 et seulement 20% en 2002.
[4] Chiffres Eurostat.
[5] Mazraa : mot arabe qui veut dire une ferme/ une exploitation.

de la municipalité de Beyrouth, constituant ainsi un outil d'approvisionnement de la ville en viande rouge (bovine et ovine).

Tableau 1. Les abattages dans les abattoirs agrées et non agrées dans le Grand Beyrouth selon les principales régions d'abattage (estimation 2002) (Source : Résultats de notre enquête 2002/2003 avec les estimations du Syndicat des Marchands de bétails et des bouchers de Beyrouth)

La région d'abattage	Nombre de têtes bovines abattues /mois (enquête)	Nombre de têtes bovines abattues /an (calculé)	Part d'abattage	Observations
Abattoir Municipal provisoire de Beyrouth	1314	15 770	7%	Selon les registres de l'abattoir 2002
"El Fanar" (zone 53)	1848	22 176	9%	Selon l'enquête
Abattoir municipal de "Bordj Hamoud"	120	1440	1%	Selon l'enquête
"Sabra" et "Cheouifat" (zones 9 et 44)	2208	26 496	11%	Abattage à "cheouifat", une partie vendue sur lieu et l'autre à "Sabra"
"Furn El Chebak"	440	5280	2%	Selon les estimations du Syndicat
Autres	2100	25 200	10%	Abattages clandestins et d'autres au niveau des tueries non agrées
Total des abattages dans le Grand Beyrouth	8030	96 360	40%	

Les abattoirs privés, en réalités des tueries particulières, appartenant soit aux importateurs soit aux chevillards se répartissent essentiellement entre la région de "Fanar", "Sabraa", "Cheouifat", "Sin el Fil" et "Furn el chebak" et plusieurs tueries dans la région "El Dhahia" (quartier ouest de Beyrouth). La majorités de ces abattoirs sont non agrées par l'état. Cependant ils effectuent chaque soir le contrôle au niveau de l'abattoir provisoire et payent les taxes pour ce qui est de la marchandise vendue uniquement dans la municipalité de Beyrouth.

Importance socio-économique du secteur de la transformation de viande bovine

A première vue l'activité de l'approvisionnement en viande bovine dans le Grand Beyrouth est considérée comme une activité commerciale. En réalité, son rôle va au-delà de l'approvisionnement alimentaire. Elle constitue une source de revenu pour une bonne partie de la population (appelée "oulades el arab", enfants des tribus arabes) et une bonne communauté d'émigrés (syriens, égyptiens et palestiniens). Elle organise la vie des quartiers "El Quarantina" "Sabra" et constituent un lien de sociabilité et de circulation de l'information.

Plus de 60 unités d'abattage qui concentrent les abattages. Plusieurs entreprises ont cessé "momentanément" leurs activités de transformation pour diverses raisons telles que les faillites financières, restructuration et investissement en infrastructure.

Le secteur de la transformation de la viande est caractérisé par la présence de deux principaux types d'unités qui sont:

(i) Les petites unités "artisanales" qui se sont développées très rapidement autour de la capitale Beyrouth en quantité et en potentialités relativement importantes dans la production de viande pour les raisons suivantes :

- D'abord, l'augmentation rapide de l'offre de la viande (baisse des prix sur le marché international), qui, en l'absence d'un système de commercialisation organisée, a révélé la nécessité de nouvelles unités de transformation.

- Ensuite, la création d'"ateliers" qui, compte tenu du matériel et des technologies requis, ne nécessitent pas de grands capitaux. Du point de vue des investissements, la construction d'un petit abattoir artisanal était accessible pour un grand nombre de personnes (rappelons l'importance des revenus d'émigration).

- Enfin, l'expérience personnelle de tous ceux qui ont créé une unité artisanale de transformation de viande ; c'était un facteur important pour le développement de ce sous-secteur. La majorité exerce le métier de père en fils.

(ii) Les grandes unités, assimilées au type industriel dans les conditions actuelles de l'environnement socio-économique libanais. Il s'agit, généralement, de propriétaires de "mazraa" associées à un abattoir de service. La quantité d'abattage est plus remarquable. Elles éprouvent beaucoup plus de difficultés que les ateliers artisanaux à se moderniser. Le manque de capitaux financiers nécessaires au remplacement de leurs anciennes technologies, les difficultés de gestion, la concurrence des petites et moyennes unités artisanales et la concurrence de la viande congelée, sont les principaux obstacles à leur restructuration.

Si les unités artisanales sont actuellement plus efficaces que "les grandes unités", c'est parce qu'elles sont favorisées par la simplicité des techniques de production, l'absence des contrôles de qualité, et les faiblesses du système fiscal. *Cela peut paraître paradoxal mais c'est justement à cause des faiblesses, techniques, économiques et institutionnelles que le sous-secteur artisanal s'est très vite développé pendant ces dernières années de transition structurelle et économique au liban*.

Le modèle actuel de la consommation et les habitudes alimentaires des libanais se révèlent aussi être une contrainte importante pour le développement du secteur de la transformation. Le consommateur libanais, en préférant consommer les viandes produites de façon traditionnelle chez le boucher ou chez l'éleveur directement dans les meilleurs des cas et n'ayant pas trop l'habitude d'acheter de la viande dite "emballée", pénalisent le développement de la production industrielle de la boucherie. En outre, ses préférences pour la viande fraîche ne peuvent que favoriser un type de circuit court qui ne nécessitent pas des dispositifs de froid lourds.

Structure de la filière viande au Liban?

L'approvisionnement en animaux, issus de l'importation, se fait directement au niveau du port de Beyrouth ou à la ferme des importateurs. L'état du marché détermine le lieu d'approvisionnement : la disponibilité d'animaux sur le marché influe sur la baisse des prix et les chevillards s'approvisionnent au niveau des fermes avec un meilleur choix des animaux ou directement au niveau du port.

Les difficultés d'approvisionnement sont dues au manque de bétail sur les marchés, au prix onéreux et au mauvais état du bétail. Ces difficultés apparaissent surtout durant les périodes de fêtes et les jours fériés en Europe et pendant les périodes de mauvais temps en mer. Durant cette période, tous les acteurs ont recours aux stocks dans les fermes.

Dans le Grand Beyrouth, les circuits d'approvisionnement sont relativement courts. L'approvisionnement est assuré dans un rayon de 50 à 80 km du lieu d'abattage et la durée entre l'abattage et la commercialisation est inférieure à 48 heures (Fig. 2).

Une forme familiale des entreprises et une multi-activité prononcée

La forme familiale marchande domine (13 entreprises/31). Les intérêts individuels et familiaux priment sur l'intérêt collectif. La faiblesse des charges salariales et le travail familial non rémunéré, entraînent une diminution des coûts de production. On constate une division des taches au sein de l'entreprise familiale : le chef d'entreprise, se charge des activités dites "importantes !", liées aux négociations des prix. En revanche, les fils ou petits frères s'occupent de l'écoulement de la viande et de sa distribution chez les clients. Pour les entreprises privées, Les propriétaires sont eux-mêmes chefs d'entreprises. Ils assurent l'approvisionnement en bétail, supervisent l'abattage et effectuent intégralement la vente.

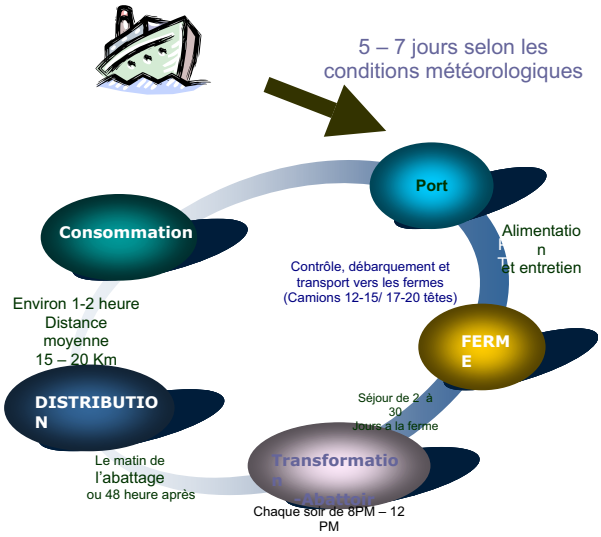

Fig. 2. Différentes étapes de la filière viande bovine au Liban (bétails vivant). Source : Zitouni (2003).

Environ 50% des entreprises ont moins de 10 salariés. Le travail journalier est dominant et la main d'œuvre est payée à la semaine (entre 75 et 200 § /semaine). Evidemment, le salaire diffère selon l'expérience et la nature de la tache effectuée.

Une multi-activité très prononcée caractérise les acteurs du Grand Beyrouth. Cependant la principale activité génératrice du revenu reste l'achat du bétail et son abattage (68%) suivie par le métier de boucherie (41%). Les prix du détail varient entre 5000 à 7000 LL/kg (3-5 $US/kg). La stratégie d'intégration verticale montre le bénéfice que le chevillard tire de sa boucherie : stratégie de gestion de l'imprévisibilité, et du risque engendré par la difficulté de récupérer les recettes en aval qui se transforment souvent en créances. Le boucher artisan est considéré par certains chevillards comme "agent intermédiaire", contribuant à l'allongement de la filière et la rupture du contrat informel.

La viande est écoulée en bonne partie le soir de son abattage au niveau même du lieu de sa production (9,7% dans l'abattoir provisoire et 16,1% dans les fermes). Toutefois, la majorité de la viande est vendue dans les points de vente (demi grossiste et boucheries) et au niveau du marché demi gros de SABRAA à peu de distance de son lieu de production. Souvent effectué par voiture, la réduction des coûts de transports permettent de mettre les produits à des prix correspondants à la demande. Il convient néanmoins de signaler le non-respect de la chaîne du froid au cours de ce transport, raison principale de la proximité des lieux de commercialisations des lieux de production (circuit court). Les moyens de conservation sont surtout utilisés en cas de baisse de vente. La viande qui a subi une conservation voit son prix baisser incitant l'écoulement immédiat de la viande.

La mise en marché et la commercialisation

Le marché de la viande bovine dans le grand Beyrouth répond à un schéma de concurrence particulier :

(i) La majorité des entreprises produisent une gamme de produits quasi homogènes à des prix quasi stables ;

(ii) Aucun acteur n'exerce de pouvoir significatif sur la quantité offerte ou sur la formation du prix ;

(iii) Absence de toute sorte de barrière réglementaire, notamment à l'entrée, qui permet aux nouveaux entrants (produits substituables tels que le congelé et le surgelé) de tirer des profits importants en entraînant avec leur entrée une baisse de la valeur de la viande fraîche ;

(iv) Des unités d'abattage en très grand nombre, dont la majorité de petite taille, de sorte que la quantité offerte par chacune d'elle sur le marché ne représente ni poids ni effets significatifs ;

(v) Des produits similaires par une non différenciation de la viande. Le pouvoir de convaincre et le savoir commerçant des libanais ont rendu la plupart des consommateurs indifférents ;

(vi) En raison du nombre réduit d'importateurs et de la source unique d'approvisionnement (importation), l'information sur les quantités offertes, les prix proposés et les transactions effectuées, est diffusée de manière exclusivement informelle.

Il en résulte un très bas niveau de marge, des profits faibles (par rapport au chiffre d'affaires), donc une faible capacité à investir ou à mettre en œuvre des systèmes de contrôle de l'hygiène. Quant au choix des canaux de distribution et des surfaces de commercialisation, les entreprises ne développent pas de grandes stratégies. L'optimum pour les producteurs est de pouvoir écouler leurs productions dans les grands magasins et les grandes surfaces. Ceci leur permet d'améliorer leur force de vente, réaliser la promotion de leurs ventes et assurer des relations permanentes avec la clientèle.

La conduite de la filière

Hors du contrôle de l'Etat, la forme contractuelle entre chevillards, fournisseurs et clients est la forme orale. La tradition a préservé des liens sociaux forts entre les acteurs dans une même zone géographique. C'est une manière de se protéger de l'imprévisibilité et de partager collectivement les risques. Aussi, dans la conjoncture qui prévaut au Liban, les acteurs sont contraints d'adapter en permanence leurs stratégies de développement. Ces conventions constitueront une garantie pour toutes les parties qui organiseront ainsi l'approvisionnement de la ville de Beyrouth en viande. L'étroitesse du pays assure la transparence de l'information sur les prix et le paiement selon la qualité n'existe pas.

Quels enseignements, théoriques et pratiques, l'étude de la filière nous apporte-t-elle ?

(i) *La création et le développement de petites et moyennes entreprises (PMEs) de transformation* de viande (artisanales dans ce cas) en milieu périurbain de Beyrouth est marquée par des relations à la fois de concurrence et de coopération entre les acteurs :

- les petites entreprises sont en concurrence entre elles parce qu'elles cherchent toutes à maintenir leur place dans le marché,
- la concurrence, quoi que timide, se manifeste surtout par le contrôle des zones d'approvisionnement et du prix de vente des produits transformés,
- toutes ces PMEs sont crées et fonctionnent sur la base des relations de coopération - confiance qui caractérisent les relations sociales dans cette zone géographique. Une "pénalisation collective" s'installe dés la rupture d'un contrat moral et l'acteur est "naturellement" exclu de l'activité par les autres acteurs.

(ii) *Sur le plan institutionnel,* l'Etat ne peut plus jouer ni le rôle d'organisateur de la production et des échanges, ni le rôle de banquier pour financer les investissements privés. Par contre, il peut et doit contribuer à la mise en place d'infrastructures physiques et institutionnelles qui permettent l'accès au marché et la concurrence loyale entre tous les acteurs.

(iii) Pour *l'approvisionnement alimentaire,* il semblerait que le système d'approvisionnement périurbain ne soit pas vraiment en concurrence mais complémentaire pour la satisfaction du consommateur. Le consommateur ne fait pas appel aux mêmes modes d'approvisionnement selon les produits. Pour certains d'entres eux, la relation de confiance et de fidélité est très forte et seules des filières courtes peuvent préserver cette relation. Par ailleurs, compte tenu des infrastructures, le périurbain semble plus approprié pour les produits frais ou périssables, le rural pour des denrées qui ne pâtissent pas de longs trajets (Padilla et Bencharif, 2001).

Quel avenir pour la filière à moyen terme ?

La mondialisation et l'adhésion du Liban à l'OMC vont jouer un rôle déterminant pour l'avenir de la filière viande. La mondialisation entraînera l'amplification de l'économie de marché. Les régulations et réglementations imposées par l'OMC mettront le Liban dans l'obligation de normaliser ses produits. Cela nécessitera le développement de sa filière et un remaniement de ses politiques, alimentaire et agricole. Un projet de contrôle sanitaire de la municipalité jouera un rôle essentiel dans la répartition des rôles entre tous les acteurs et constituera un mécanisme évident de régulation.

L'évolution de la filière à moyen et long terme obligera les unités de transformation, notamment artisanales, soit à conforter la différenciation de leurs produits (stratégies de la "niche"), soit à procéder à des investissements technologiques et donc à améliorer leurs techniques de production.

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Demand analysis for dairy products in Tunisia: An econometric approach

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SUMMARY – The present paper analyses the demand for dairy products in Tunisia using the CBS model for the 1973-2002 period. Expenditure elasticities indicate that butter and cheese can be considered luxury goods. In the other hand, milk is considered as a normal good. However, expenditure elasticity of yogurt suggest it a necessity in the Tunisian diet. Result from Marshallian elasticities indicates that the resulting demand for dairy products is inelastic. Cross-price elasticities show strongest competitive relationship between cheese and milk, in one hand, and between butter and yogurt, from another. Finally, a quality change index (QCI) of dairy products consumption is constructed and decomposed into real expenditure effect, substitution effect, trend effect and residual effect. Results show that there is a moderate increase in quality in consumption of dairy products by 0.068% per year during the total period. However, the quality changes of dairy products consumption in Tunisia decrease since 1988.

Keywords: Dairy products consumption, CBS model, price and expenditure elasticities, Quality Change Index (QCI), Tunisia.

RESUME – "Analyse de la demande de produits laitiers en Tunisie : Une approche économétrique". Le présent travail a pour objectif l'analyse de la demande des produits laitiers en Tunisie en se basant sur le système de demande CBS pour la période 1973-2002. Les valeurs des élasticités dépenses du beurre et du fromage dépassent l'unité et sont considérées donc comme des biens de luxe. Le lait est révélé comme un bien normal. Cependant, le yaourt est considéré comme un bien de première nécessité dans la diète tunisienne. Les résultats de recherche obtenus à partir des élasticités marshalliennes ont montré que la demande de produits laitiers est inélastique. Les élasticités croisées ont suggéré une forte relation de substitution entre le fromage et le lait frais, d'une part, et entre le beurre et le yaourt, d'autre part. Finalement, un Indice de Changement de la Qualité (QCI) des produits laitiers a été construit. Dans un deuxième temps, cet indice a été décomposé en un effet réel des dépenses, un effet de substitution, un effet tendance et un effet résiduel. Les résultats de cette décomposition ont montré une légère augmentation dans la qualité de consommation des produits laitiers durant l'ensemble de la période, avec une moyenne annuelle de l'ordre de 0,068%. Toutefois, cet indice décroît depuis 1988.

Mots-clés : Consommation des produits laitiers, modèle d'analyse CBS, élasticités prix et dépenses, Indice de Changement de la Qualité (ICQ), Tunisie.

Introduction

Since 1986, the Tunisian economy fell into recession. In response, the government designed and implemented a structural adjustment program which affected the subsidies system. One of the sectors, Tunisian dairy sector, was strongly supported by government intervention in the form of price policies and subsidies. However, several government policies were instituted which influenced the dairy sector. Prices controls were put in at every level of milk production and marketing (production, processing and consumption). Moreover, a national strategy of development of the sector was implemented in 1994 in order to reduce imports and reach self-sufficiency in dairy products at 2000. This policy was based on integrated policies of production, collection and transformation. This led to a high expansion in milk production (167 millions litters in 1970, to 934 million litters, in 2001).

Accordingly, milk and dairy consumption sector was affected by these phenomena. Thus, the evolution of the dairy consumption structure in recent years shows that the pattern of dairy consumption has been constantly changing (Khaldi and Naili, 2001; Laajimi et al., 2003; Dhehibi and Gil, 2003). Making available information on expected dairy products demand will facilitate policy makers to estimates social welfare and market adjustments under alternative policies (prices policy, subsidies policy, etc.) in order to identify the improvements that be made to achieve self sufficiency and avoid the disequilibrium between demand and supply.

Given the above, the objective of this paper was to estimate and determine the factors influencing the demand for dairy products in Tunisia using a quantitative approach. In order to reach these objective the paper is organized as follows. In the next section, we discuss the structure and evolution of dairy food consumption in Tunisia. The methodological framework is specified in the third section. First a description of the demand model employed is developed. Second, data and estimation procedure are explained. Finally, a quality change index (QCI) is constructed from the CBS model estimation and decomposed. Section 4 describes the empirical results and discussions. The final section summarizes major findings and conclusions.

Structure of dairy consumption in Tunisia

In Tunisia, daily per capita calorie intake has substantially increased in the last 30 years at an annual growth rate of 1.6% (2278 kcal, in 1970, and 3238 kcal, in 2002). On the other hand, the proportion of calories coming from animal products still is very low and hardly reaches 10.7% of total calorie intake due to the high consumption of poultry and less consumption of other meats with relatively higher prices in comparison to other food products.

According to the statistics of INS (National Statistic Institute), the consumption of animal products has substantially increased along the period 1975-2000. In 1975, both food groups represented around 10.4% of total food expenditure while in 2000 this percentage reached 12.2%. It is noteworthy that the importance of this percentage is due to increased milk and milk products budget share into animal food group. The relative importance of dairy and dairy products increased from 2.8% to 4.2% in total food products indicating the importance of dairy products into Tunisian diet.

Milk and dairy products consumption in Tunisia has experienced several changes, not only in terms of expenditure as indicated above but also in terms of quantities. The quantity of consumed milk was increased by 9.63% over the last three decades, despite of slow tendency to decreasing since 1985. This aspect, jointly to a decrease in the real expenditure, indicates a decrease in relative prices. Among the products that showed a straight increase in the quantity consumed, there are cheese (600%) and butter (57.14%). After a decrease in 1995, yogurt recovered an increasing trend (5%, over the 1995-2000 periods). However, it can be observed that dairy consumption is irregular and non-uniform, especially for yogurt and cheese. The observed fluctuations between 1980 and 2000 are still linked to the agricultural production level, particularly during the final of 90's, characterized by difficult farm harvests. Moreover, we can notice, in general, that consumption of dairy products has increased due to change of habit consumption for Tunisian households.

Methodological framework

Empirical model

The CBS system developed by Keller and Van Driel (1985) is one of the flexible demand systems that is expressed as a system of linear equation behavioural parameters. It is a so-called demand differential system based on the differential equation for the budget shares of the consumer goods. The derivates or functions of derivates of this equation are assumed to be constant, in order to obtain estimable expressions.

Depending on which constancy assumptions are made, we may obtain different versions of this differential equation, so it is a whole family of differential consumer demand systems which includes the Rotterdam Model (Theil, 1980) and the differential version of the Almost Ideal Demand System

(Deaton and Muellbauer, 1980). This specification implies that dairy products items are separable from the other food items in the consumer budget. Therefore, weak separability of preferences has been assumed and the multi-budgeting process is then justified. First the consumer determines the amount of expenditure devoted to food purchases. Then, he/she distributes this amount among the food products.

The negativity of own-price substitution terms and the relationships between net substitutes and complements can be immediately obtained from parameter estimates. Income and price elasticities in this system are also linear in parameters. Hence, it is possible to test the statistical significance of all elasticities.

The CBS model application for food products demand has been accomplished by a number of studies (Fousekis and Pantzios, 2000; Van Driel et al., 1997; Lee et al., 1994; Gao and Spreen, 1994, Barten, 1993, and Laajimi et al., 2003). It describes the differential change in the quantity share as a function of changes in the total expenditure and price.

The CBS demand specification for the i^{th} type of dairy product is:

$$w_i \, d\log q_i = (w_i + \beta_i) \; d\log Q + \sum_{j=1}^{n} \pi_{ij} \, d\log p_j \quad i = 1, 2, \ldots, k \quad (1)$$

Where:

$d\log Q = \sum_{j=1}^{n} w_j \, d\log q_j = d\log y - \sum_{j=1}^{n} w_j \, d\log p_j$ is total real dairy products expenditure implicitly

q_i : quantity of the i^{th} type of dairy food
p_i : price of the i^{th} type of dairy food
y : value of total expenditure in dairy products
w_i : is the budget share of good i, $w_i = p_i q_i / y$
k : is the number of dairy goods

The parameters β_i and π_{ij} (the price Slutsky coefficients) are assumed to be constant.

The theoretical restrictions of adding-up, homogeneity and symmetry, implied by demand theory, are satisfied by the following parametric restrictions:

Adding-up : $\sum_{i=1}^{k} \beta_i = 0, \quad \sum_{i=1}^{k} \pi_{ij} = 0$ (2)

Homogeneity: $\sum_{j=1}^{k} \pi_{ij} = 0$ (3)

Symmetry : $\pi_{ij} = \pi_{ji}$ (4)

The negativity condition is $\sum_{i=1}^{k} \sum_{j=1}^{k} \tau_i \; \pi_{ij} \tau_j \leq 0 \;, \forall \; \tau$ (5)

Indicating that the matrix Π, must be negative semi-definite of rank k-1. The negativity condition implies that the eigenvalues of Π matrix must all be no positive. Since the rank of Π is (k-1) therefore, the negative semi-definite condition requires the eigenvalues to be one zero and (k-1) negatives.

Elasticities can be calculated from the estimated parameters as follows:

- Total expenditure: $\eta_i = \frac{\beta_i}{w_i} + 1$ (6)

- Marshallian price elasticities: $E_{ij} = \frac{\pi_{ij}}{w_i} - \eta_i \, w_j$ (7)

- Heksian price elasticities: $$\varepsilon_{ij} = \frac{\pi_{ij}}{w_i} \qquad (8)$$

Data and estimation procedure

Data description

The annual consumption data for fresh milk, butter and cheese are collected from the Food Balance Sheet elaborated by the Food and Agricultural Organization (FAO). In order to get per capita data, population figures were collected from the same source. Consumption per capita of yogurt is approximated by the supply of this food elaborated by the Ministry of Industry for Tunisia divided by the population. Annual consumer price series for each commodity are found in the monthly statistical bulletin of Tunisia published by the INS (National Statistics Institute). Four dairy products are used in the analysis: fresh milk, yogurt, butter and cheese. The sample period covers yearly data from 1973 to 2002.

Estimation procedure

The CBS model (1) reads in differentials. In order to arrive at estimable equations it has to be converted to finite changes (Van Deriel et al., 1997). However, for estimation we need to work with finites change and follow the usual practice of approximating w_{it}, $dlogp_{it}$ and $dlogq_{it}$ for $\frac{(w_{it} + w_{it-1})}{2}$, $\log \frac{p_{it}}{p_{i,t-1}}$ and $\log \frac{q_{it}}{q_{i,t-1}}$, respectively, where subscript t indicates time.

The empirical model specified for this study (1) was estimated using the Full Information Maximum Likelihood (FIML) procedure. The "cheese" equation was deleted to avoid singularity of the variance and covariance matrix of residuals due to the adding-up restriction. Restrictions imposed by economic theory (homogeneity and symmetry) were tested. Results indicates that both of these restrictions are not rejected at the standard statistical criteria (5% level of significance), it means that the model is consistent with economic theory.

Quality change and its decomposition in Tunisian dairy products consumption

Taking into account that quality concept measures the desirability of the consumption basket from the consumer's point of view as revealed by his behaviour. Moreover, the term quality change in consumption does not involve any judgment ex-ante what is good and what is not for the consumer.

In conclusion, commodities for which the marginal share exceeds the corresponding budget share are more attractive in preferences to the consumer. Based on this analysis, Theil (1980) has been used to calculate a quality change index (QCI) and to decompose it into real expenditure, substitution, and other effects.

The following quality change index (QCI) in consumption in differential form is given as:

$$QCI = d\log Q^F - d\log Q \qquad (9)$$

Where $dlogQ^F$ is the Frisch quantity index, which weighs quantity changes of individual commodities by the respective marginal shares.

For the CBS model, the QCI can be developed as:

$$QCI = \sum_{i=1}^{n} \beta_i \, d\log q_i \qquad (10)$$

To quantify QCI, equation (1) is substituted into equation (10). Result from this substitution is given as:

$$QCI = \sum_{i=1}^{4} \beta_i (c_i / w_i) + \sum_{i=1}^{4} \beta_i (\beta_i / w_i + 1)_i \, d\log Q \qquad (11)$$
$$+ \sum_{i=1}^{4} \sum_{j=1}^{4} \beta_i (\pi_{ij} / w_i) + \sum_{i=1}^{4} \beta_i (u_i / w_i)$$

Where:

QCI	: Quality Change Index
i, j =1, ., 4	: Attach to fresh milk, yogurt, butter and cheese
C_i	: Coefficient associated with trends

The equation (11) decomposes the QCI into a:

- Trend Effect: $$TE = \sum_{i=1}^{4} \beta_i (c_i / w_i) \qquad (12)$$

- Real Expenditure Effect:
$$REE = \sum_{i=1}^{4} \beta_i (\beta_i / w_i + 1)_i \, d\log Q \qquad (13)$$

- Substitution Effect:
$$SE = \sum_{i=1}^{4} \sum_{j=1}^{4} \beta_i (\pi_{ij} / w_i) \qquad (14)$$

- Residual Effect:
$$RE = \sum_{i=1}^{4} \beta_i (u_i / w_i) \qquad (15)$$

Results and discussion

With respect to the specification test, none of the equations of the model show autocorrelation problems, because all values of this test are clearly lower than the critical value at the 5% level of significance, $\chi^2(1)=3.84$. Hence our specification is acceptable from an econometric point of view. Parameter estimates of the CBS model are used to calculate the price and expenditure elasticities. Table 1 shows the expenditure, own and cross-price elasticities, evaluated at the mean point of the explanatory variables. These values are reasonable in signs and magnitude and, for the most part, are individually significant. All expenditure elasticities are positive and significant at the 10% level. Expenditure elasticities of butter and cheese are greater than one, indicating that they are luxury goods. Whereas, expenditure elasticity of milk is very close to unity, so it can be considered as a normal good. However, expenditure elasticity of yogurt is less than the unity and suggest it a necessity in the Tunisian diet.

Milk product is considered as a normal good, since the corresponding expenditure elasticity close to one (1.024) and statistically different from zero. This result is plausible taking into account the importance of this product in the diet. Expenditure elasticity of yogurt is less than the unity, although significant, indicates that this product may be considered as an inferior good. It is important to notice the decrease consumption responsiveness of yogurt to income increases. The descriptive analysis confirms this result, since the relative proportion of the budget allocated to yogurt is loosing importance as part of total expenditure allocated to dairy products. Butter exhibits higher expenditure elasticity. Such result seems to be implausible, but not if it is borne in mind that retail price of this product is higher and increase rapidly in the last years of study.

The expenditure elasticity obtained for cheese is plausible in magnitude, since an increase in dairy products expenditure would induce more than proportional increase in the demanded quantity. This indicates the new trend and changes that occurred in the food structure (consumption away from home), since consumption on this product is increasing, particularly in urban areas, as a response to income increases.

Table 1. Expenditure, own and cross price elasticities for demand of dairy products in Tunisia

	Milk	Yogurt	Butter	Cheese
Expenditure elasticities	1.024 (21.50)	0.235 (2.59)	1.39 (1.86)	1.29 (4.37)
Marshallian elasticities				
Milk	-0.84 (-30.65)	-0.079 (-14.52)	-0.053 (-2.69)	-0.044 (-1.62)
Yogurt	-0.24 (-4.00)	-0.19 (-2.48)	0.15 (2.78)	0.047 (0.73)
Butter	-1.41 (-3.42)	0.206 (1.97)	0.62 (1.003)	-0.80 (-2.93)
Cheese	-0.73 (-4.50)	-0.028 (-0.35)	-0.44 (-1.87)	-0.045 (-0.163)
Hecksian easticities				
Milk	-0.094 (-0.34)	-0.0048 (-0.87)	-0.013 (-0.66)	0.027 (1.93)
Yogurt	-0.05 (-0.87)	-0.17 (-2.26)	0.164 (2.94)	0.064 (0.83)
Butter	-0.27 (-0.66)	0.309 (2.94)	0.67 (0.85)	-0.71 (-1.66)
Cheese	0.31 (1.93)	0.066 (0.83)	-0.39 (-1.66)	0.0091 (0.033)

Note: t-ratios are in parenthesis.

Results from own-price elasticities indicate that the resulting demand for dairy products is inelastic. That is, changes in own prices have inverse impacts on quantities demanded. Among the three products there composed this food group, own price elasticity of milk is the largest in absolute terms, followed by yogurt and cheese. Cheese product is more prices inelastic, implying that consumption of this dairy product is not sensitive to price change. Hence, if prices and income (total expenditure) changes at the same time, consumption would be more affected by income than prices.

From compensated prices elasticities, it can be observed that cheese has the strongest competitive relationship with milk. Cross-price elasticity of cheese with respect to milk is greater than that of milk with respect to cheese. This implies that the price of cheese does not have an influence on the consumption of milk while the price of milk affects the consumption of cheese. This is because consumer's in Tunisia consumed more milk than cheese. Another competitive relationship can be appointed between butter and yogurt. This result indicates that the price of better does not have an influence on the consumption of yogurt while the price of yogurt affects the consumption of better. It appears also a complementary relationship between butter and cheese implying that the consumption of butter is influenced by the price of cheese. This is true when regarding the evolution of prices of these dairy products along the period of study.

Parameter estimate of the CBS model were used to calculate and decompose Quality Change Index (QCI) into real expenditure effect, substitution effect, trend effect and residual effect. Results from this decomposition for the analysis period and for the different sub-periods (1973-87, 1988-94, and 1995-02) are showed in Table 2. Empirical results suggest that over the period of analysis, there is a moderate increase in quality of consumption for dairy products by 0.068% per year. The real-expenditure effect decreases with the dispersion of expenditure elasticities among the four dairy products. This is due to the fact that the Divisia quantity index decreases over the sample period.

As well as regarding the substitution effect, it appears that values of this term become positives. In definition, the substitution effect becomes positive when the price of goods for which the marginal share exceeds the respective budget share tends to decrease relative to the rest of goods. This is

true, in our case, since the prices of butter and cheese, for which the expenditure elasticities are greater than unity, 1.39 and 1.29, respectively, have decreased faster than the prices of the rest of others dairy products, namely fresh milk and yogurt.

Table 2. Quality change index (QCI) and its decomposition for demand of dairy products in Tunisia

Periods	QCI	Real expenditure	Components of quality change		
			Substitution	Trend	Residual
1973-1987	0.105	0.002	0.007	0.09	0.0043
1988-1994	0.048	9.8E-04	0.004	0.05	-0.008
1995-2002	0.021	2.9E-04	0.008	0.009	7.7E-04
1973-2002	0.068	0.0013	0.0069	0.06	1.39E-04

Source: Own elaboration.

The trend effect is positive since β and c coefficients have the same sign in each equation of the system. Given that, the trend effect and QCI are very similar not only for the sample period but also for the different sub-periods. Thus, the change in QCI must be attributed to change in the trend effect. Finally, the residual effect is not significant.

Concluding remarks

Elasticity estimates are critical parameters in developing countries for policy analysis. Elasticities used in past applied models in Tunisia have been calculated at aggregated level (total food) and to the authors' knowledge, this investigation constitutes the first attempt to empirically estimate dairy products in Tunisia using demand systems.

Results from quantitative analysis showed that expenditure elasticities of butter and cheese are greater than one, indicating that they are luxury goods. Expenditure elasticity of milk is very close to unity, so it can be considered as a normal good. However, expenditure elasticity of yogurt is less than the unity and suggest it a necessity in the Tunisian diet. The findings from Marshallian elasticities indicate that demand for dairy products is inelastic. Cheese product is more prices inelastic, implying that consumption of this dairy product is not sensitive to price change. Hence, if prices and income (dairy expenditure) changes at the same time, consumption would be more affected by income than prices. Moreover, cross-price elasticities show strongest competitive relationship between cheese and milk, in one hand, and between butter and yogurt, from another. This result indicates that the price of better does not have an influence on the consumption of yogurt while the price of yogurt affects the consumption of better. In addition, a complementary relationship between butter and cheese is outlined, implying that the consumption of butter is influenced by the price of cheese.

The findings from quality change index (QCI) decomposition of dairy products consumption in Tunisia show that there is a moderate increase in quality in consumption of dairy products by 0.068% per year. It appears also that the quality change of dairy products consumption in Tunisia decrease over the period of analysis.

Finally, results obtained in this paper are strictly conditioned to the chosen bundle of dairy products categories, the sample period and the used model. However, it would be more interesting from policy maker point of view to analyse the influence of socio-demographic characteristics (level of education of household head, size of town, socio-professional categories, income classes, etc.) of consumers. Such analysis can be also improved by incorporating other determinants of food consumption such as nutrition quality, the nutrient content of food and the increasing concern about health.

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Adversities and opportunities in the production of "Oscypek" cheese and in the traditional grazing system of Polish Mountain Sheep

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SUMMARY – The traditional grazing system of sheep in the Polish Mountains is mainly aiming at preserving the folkloristic customs and the natural landscape. Sheep pasturing and milking is linked to the hand-made processing of many regional produces. Among them, the "Oscypek" cheese is still produced in a traditional way, unchanging over 500 years. "Oscypek" was the only one produce from Poland which has been showed at the "Slow Food Hall of Taste" (Salone del Gusto). Unfortunately, it did not obtain the European PDO certification. The registration as Protected Designation of Origin brand should help producers to achieve profitable prices and increase the profitableness from the sheep production systems in the mountainous regions.

Keywords: Sheep, traditional grazing, "Oscypek" cheese.

RESUME – "Les problèmes et les nouvelles possibilités en ce qui concerne la production du fromage régional de brebis nommé "Oscypek" et le pâturage traditionnel de moutons polonais de montagne". Le but du pâturage traditionnel est de garder la tradition et de protéger l'environnement naturel. La richesse naturelle de Tatras dépend principalement de la continuation de l'utilisation des pâturages de montagne. Le pâturage des moutons, accompagné par la traite, est lié à la production des nombreux produits régionaux. La production du fromage "Oscypek" se fait depuis plus de 500 ans, toujours de la même façon. A la Foire des produits régionaux "Salone del Gusto", "Oscypek" a été le seul produit présenté par la Pologne. Néanmoins, jusqu'à présent, ce fromage n'a pas obtenu de certificat européen d'AOP. Il est à noter que l'octroi du label d'Appellation d'Origine Protégée permettrait aux producteurs d'obtenir des prix rentables et d'accroître le rendement de l'économie ovine dans les régions de montagnes.

Mots-clés : Moutons, pâturage traditionel, fromage de brebis du type "Oscypek".

Introduction

In the 1980s, 150 million sheep were on pasture in Europe (Mirek, 2004b). Traditional grazing with local breeds made the basis of the European economy for centuries and at the same time it was a creative factor linked to the culture in many regions. Sheep grazing contributed to the formation of many grassland biotypes, with a large variety of flora and fauna. Pasturing was also strictly connected to material and spiritual culture as reflected in buildings, ceremonies, beliefs, costumes and regional products, which are associated with pasturing.

At present, extensive farming systems exists mainly in difficult mountain regions, which are often outlying from the market. Currently, one of the main purposes of the European Union policy is to support extensively food production. Taking into consideration the protection of regions of great natural and cultural worth, a satisfactory income level has to be secured for herd owners (Kuznicka and Kucharska, 2004).

Shepherding on mountainous regions of Poland

The colonization of the Carpathian Mountains and Tatra Highlands took place during the 11^{th}-13^{th} centuries. Beside the way land was managed, the dominant form of husbandry in that region was sheep breeding, based on pasturing and sheep milk product processing which were the main occupations of highlanders (Kucharska and Kuznicka, 2005). During the interwar period in Tatra

Highlands there was around 6000 head of sheep, which was considered as the upper limit of the grazing potential (Gąsienica-Chmiel, 2001a). After the Second World War, 22,000 head of sheep were raised in this region. This means 4 times more than the pasture capacity (Mirek, 2004a). Because of the soil devastation, Tatra Mountain National Park was established in 1954 with compulsory acquisition of land and expropriation, which resulted in cessation of grazing in 1978. Protests of local inhabitants and forest succession as the result of pasturing relinquishment, caused in 1982 the introduction of cultural pasturing in the Tatra Mountains, which protects nature and also the culture and traditions of that region (Mirek, 2004a). Mountainous terrain in Poland comprises only 9% of the country area and has exceedingly valuable natural and landscape advantages, which allow inhabitants to achieve supplementary income from tourism and recreation services (Drozdz, 2004).

The number of head of sheep in the Polish Mountain is only 13% of all country sheep population but for common Polish citizens sheep-farming is associated with the mountains. Many tired tourists could find shelter in shepherds' huts and the views of sheep grazing on mountain pastures are mixed with picturesque landscapes. In 2003 on an area of 153.27 hectares within the Tatra Mountain National Park, there were 1470 head of sheep on pasture. The average stocking rate was 7 head per hectare, which is the optimal rate (Gąsienica-Chmiel, 2001a). The shepherds who want to take their sheep to graze within the Tatra Mountain National Park have to sign an agreement for a period of 4 years. The pasturing can start when grass is 8 cm high and ends not later than 30th September. The shepherds have to wear the regional mountaineer's costumes, use traditional equipment and its characteristic nomenclature, local dialect as well as comply with rituals related to shepherding. Cultural pasturing also requires the manufacturing of traditional sheep milk products according to long-standing technologies (Gąsienica-Chmiel, 2001b). The problematical case seems to be the charge paid for pasturing in the Tatra Mountain National Park. The payment is calculated as an equivalent to 0.5 quintals of rye (5 Euro) for 1 hectare of rented land. Conversely, in other countries landscape conservation through the use of sheep is recognized as a service activity and for this reason it receives public funding. The income increase obtained this way might stimulate the conservation of sheep flocks (Van Beek, 2002). The majority of shepherds are in retirement age. For instance, the oldest shepherd is more than 70 years old. They work following their sentiments, without thinking in any economic considerations. During the 5 month pasturing period they stay out of the house in shepherds' huts without electricity or running water. The only wages that they get from that difficult work are the revenues obtained from selling sheep milk products. It seems that financial support is necessary to make this important tradition more attractive for young people.

Cheese production from sheep milk and adversities with the sheep cheese Oscypek

As already mentioned, cheese production in the Tatra region dates back to the 15th century. The manufacturing procedure of Oscypek cheese and its associated produce is specified by traditional and not written rules kept invariable for over 500 years.

Oscypek cheese gained popularity and acknowledgement at the end of the 19th century when Zakopane came into vogue, becoming one of the major symbols of the region.

Unfortunately, its popularity prompted the production of many counterfeits in the local market with cow's milk being added or without sheep milk at all, where the smoking process was replaced by soaking in coffee or tea (www.nt.nowotarski.pl). To protect Oscypek's reknown name before the Patent Office the concerning protection laws and trademark of Oscypek and associated products, like Bundz (cottage cheese type) and Zentyca (whey) was consigned (http://www.slowfood.pl).

In 2003, Oscypek, Bundz and Zentyca obtained the national brand of origin. The certification made it possible to sell these products from raw sheep milk in the official retail networks, otherwise impossible. The quality standards for the original Oscypek has also been defined. The fat content in dry matter should be about 31% on average, the shape of spindle, cylindrical middle of 6-10 cm in diameter with characteristic convexed and conceived patterns. The Oscypek's coating should be smooth, elastic, with colour ranging from light yellow to brown. The taste and smell of smoking – spicy alternatively a little salty. The flash resilient, slightly soft, slightly firm, slightly crispy (www.slowfood.pl, Drozdz, 2001).

In order to increase the promotion, the Oscypek was the only one product from Poland showed at the Slow Food "Hall of Taste" ("Salone del Gusto") in 2003.

When Poland joined the European Union the national mark of origin for Oscypek expired. Moreover, the Slovaks, which at the other side of the Tatra Mountains produce sheep cheese with an identical method applied for the rights for this designation.

At present, the certification for Oscypek has not been obtained. The simplification of registration procedures for regional products by the European Commission (from April 2006) and the negotiations taking place with Slovak's government are doing well towards solving the troublesome situation.

The registration of the protected produce may raise the prestige and price, and it may enable differentiation on the market and may boost the attractiveness of the region. As a matter of fact, almost all tourists who visit Zakopane buy Oscypek. That is why the PDO registration is such a crucial factor.

Conclusion

The Oscypek cheese is one of the best known and popular regional produce in Poland. Its reputation should produce profits for the local system of production, which has been able to maintain the long-standing traditions of sheep grazing and manufacturing sheep milk produces. The system of protection and promotion of regional and traditional products is one of the most important factors influencing a sustainable development of rural areas. It contributes to reach employment differentiation in the rural areas by creating non-agrarian earning sources and increasing farmers' profits.

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Uncertainties and opportunities of sheep production in Extremadura

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SUMMARY – Extremadura's sheep production is one of the social-economic engines of the region. It is a productive sector that manages relevant territories linked to the conservation of the environment. Nowadays this sector has led a revolution in its production system and is working on a new organization of its verticalization capacity together with the new community frame of eco-conditions and rural development.

Keywords: Sheep production, verticalization, PDO, PGI, cheese, lambs.

RESUME – "Incertitudes et opportunités pour la production ovine en Estrémadure" La production ovine en Estrémadure constitue un des moteurs économiques et sociaux de la région. C'est un secteur productif qui gère d'importants territoires en rapport avec la conservation environnementale. Ce secteur a conclu actuellement une reconversion de son système de production et est plongé dans une structuration de sa capacité de verticalisation en parallèle au nouveau cadre communautaire d'écoconditionnalité et développement rural.

Mots-clés : Ovin, verticalisation, DOP, IGP, fromage, agneaux.

Introduction

The economy of the region of Extremadura (Vega and Murillo, 2004) presents a wide agricultural and livestock sector and a scarce transformer industry. Agricultural and farming production means 12.43% of the Gross Domestic Product (PIB) / Gross Added Value (VAB) in agriculture (in Spain it means 4.06%), while the transformer industry generated 7.73% (in Spain 17.29%), highlighting that the biggest generation of added value is not common in the agricultural and farming sector but in its transformation and distribution. The regional livestock market presents a trade structure focused on the domestic market and based on primary production, quite far from food and agriculture transformation.

Opportunities

Social-economic importance

About the agricultural incomes of Extremadura, 2060 millions € (Díaz and Sánchez, 2004), the production represents 65.12%, and the ovine productions (meat+milk+wool) 233+3+4 million €, 13% (11.3% + 1.5% + 0.2% respectively), only overcome by the pigs (15%). Considering its public incentives (99.7 mill €), the ovine production is the most all important of the regional economy (Antón, 2004).

The ovine livestock is present in 95% of municipalities of Extremadura (in Spain 86%). 3.5 mill breeding sheep is the census (MAPA, 2004), what means 18% of Spanish domestic total, and it maintains an increasing tendency (50% 05/86). Its structure shows suitable exploitations for the verticalization process. The 66% of all exploitations count on more than 500 breeding sheep, and out from them, 35% have more than one thousand.

Geographical location

Extremadura's ovine livestock shows a geographical location and a productive specialization

(López Gallego, 2003). 25% of the census is in 3% of municipalities, coexisting with 5% of caprine and 8% of bovine livestock. The ovine livestock represents 45% of the total census in the areas of La Serena (Castuera 12%), Siberia (Puebla de Alcocer 9%), Llanos de Cáceres (Cáceres 10%), Trujillo (Trujillo 8%) and Campiña (Llerena, 6%) (Fig. 1).

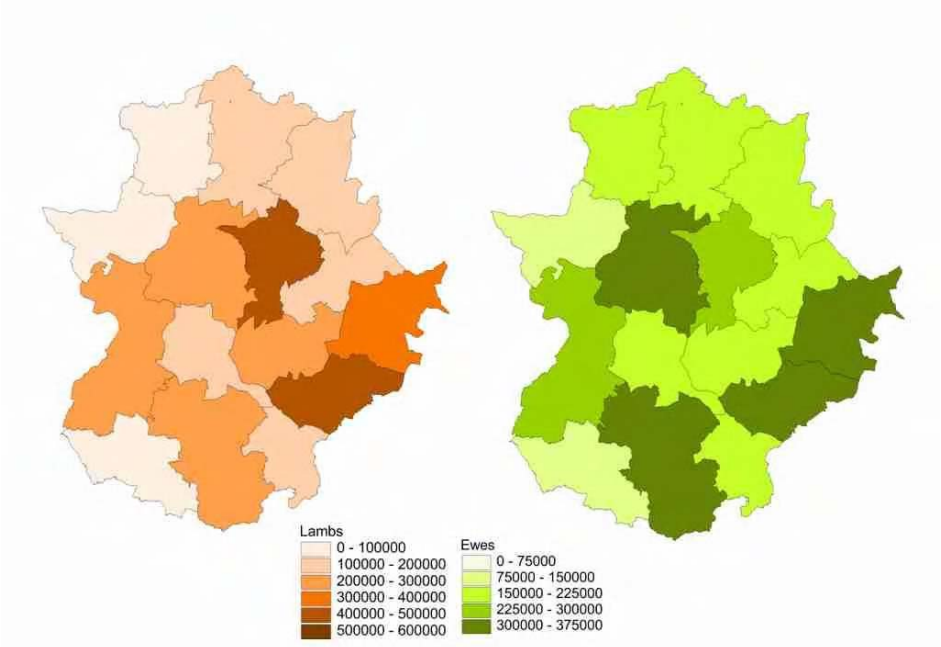

Fig. 1. Regional distribution of the ovine livestock and lamb production in Extremadura.

Partnership

Along the last years, the ovine sector of Extremadura has joined a modernization process through ovine cooperative companies. This has meant a droop in the so high level of atomization and intermediaries along the value chain. The cooperative model, expanding the initial concentration and typification of lamb offer transformation and distribution functions.

Just the two most relevant cooperatives, Oviso and Copreca (14% of Extremadura's livestock), have started with in-house transformation of their own lamb production. They market their final production instead of live animals, as it is used in the region. The total production of lamb in Extremadura, under a cooperative discipline, overpasses a million heads (53% Oviso+Copreca) and it represents 32% of the regional production.

In Extremadura, 41% of the lamb production is destined to slaughterhouses, slaughtering 15% in regional slaughterhouses (López Gallego, 2005). Oviso and Copreca slaughter in Extremadura and market 35% and 95% respectively of their production, what represents 10% of the regional production (32% of the cooperative production). The rest of the ovine sector of Extremadura market the production as live.

The cooperative lambs marketed alive are destined to slaughterhouses (48% Madrid-Centre, 35% Barcelona-East) almost located in the same markets (75% Madrid-Centre, 22% Barcelona-East), where other lamb producers converge, generating a self-concurrency for the cooperative ovine sector, joined to the rest of the non cooperative lamb production (35% Madrid-Centre, 10% Catalonia).

Commercial concentration

Five big traders overcome 45% of all the food production, being three of them the biggest operators of ovine meat (Carrefour 18%, Eroski 8% and Mercadona 5%). Out from the 12-14 big national operators of in-house transformed ovine, perhaps the four biggest (Magnus, Murgaca,

González, Copreca) manage around 65% of the total production. Extremadura has a big atomization of in-house operators, as a result of the great volume of alive livestock trade, generating a slight concentration in cooperatives, which manage 15% of the total production (495,000 lambs), and expecting, on the other hand, the management of 20% by five big buyers (Díaz, Magnus, González, Merinero and Torrejón). The rest of the regional lamb production is managed by a great deal of intermediaries.

Among the main producers and distributors of ovine meat at a national level, Copreca (3.6 mill/kg) and Oviso (1.1 mill kg) crown the market (Fernández, 2005). Nevertheless these two companies do not include quartering, where the group Cárnico Magnus SA, with a production of 12 million kg, 88% fresh (51% quartered, 49% guttered) and the cooperative group Pastores (5.1 million/kg, 19% in plates for self-service) head the market.

Commercialization

Extremadura's annual lamb production is 3.2 million (López Gallego, 2003), concentrating 40% of the regional lamb production in Castuera (15%), Trujillo (13%) and Herrera del Duque (12%). The areas of Castuera, Herrera del Duque, Trujillo and Zafra commercialize 50% of all the regional alive lambs (15, 12, 11 and 11%), they also represent 55% of the commercialized lambs to slaughterhouses (16, 13, 17 and 8%). It's supposed that 1.85 million/year of alive lambs are managed from exploitations to cattle feed facilities in and outside of the region. On the other hand, 1.28 million lambs are registered to slaughter in regional and national slaughterhouses.

The activity of the ovine cooperatives of Extremadura along the last years has established production guidelines to start a process for keeping the added value, increasing the positive results in the selling chain. Lamb production cooperatively commercialized now reaches 970,000 lambs/year (31%). Out from them 530,000 concern Oviso and Copreca (17% of the total amount in Extremadura). It also represents 29% of Extremadura's lambs that are commercialized alive.

This particular form of production is viable thanks to the start-up of typification feeding centres. After the concentration, typification and homogenization of the offer for its selling of alive lambs, speeding up the process and increasing its capacity, it regularizes the supplies chain. At the same time, it guarantees the security of products, their identification and traceability, links of the value chain required by the target markets.

Extremadura's ovine livestock has specific aspects in the market demand, along every stage of the production system, from the livestock exploitation to the logistic platform. The traceability is accredited certifications sets of the Quality Standard PGI Corderex, in the typification centres. The strict specifications are included in the distribution contracts to guarantee the possibility to search for it, they include new assumable implements for these centres and slaughterhouses (identification, waste control, inhibitors, pesticides and bacteriology).

Slaughtering in regional slaughterhouses

Lambs' slaughtering in slaughterhouses has increased from 141,000 lambs to 467,000 (1999-2005) as a result of the starting-up of the cooperative groups Oviso, in the area of La Serena, and Copreca, in the area of Llanos de Cáceres. This means that the lambs transformation in the region reaches 15% of the total production and 37% of the total amount of commercialized addressed to slaughterhouses. Out from these values, it corresponds to Oviso+Copreca 10% and 25%. About regional slaughtering, Copreca and Oviso represent 95% and 35% respectively.

The slaughtering capacity of lambs is still quite low in Extremadura. There are 84 slaughterhouses in the region, just 10 have capacity to slaughter more than 5000 lambs/year and these keep 88% of the total slaughtering. Oviso's (1000 tons/year) and Copreca's (1800 tons/year) slaughterhouses are the only slaughterhouses of Extremadura included in the 41 main national ovine slaughterhouses, which slaughter more than 500 tons. This group is headed by the group Magnus (12,000 tons), 12% of the total. These slaughterhouses are located mainly in Catalonia (23%) and in Aragón (16%); Murcia (15%); Valencia (8%); Madrid (1%); Castilla y León (16%); Castilla la Mancha (7%), and the North (9%).

Quality standard PGI (Protected Geographical Indication) Corderex

The certification of the PGI "Cordero de Extremadura (Corderex)", recognized by the Regulation Corderex (Order 9/2/97), covers both the production area and its elaboration (slaughtering and quartering in regional slaughterhouses). The main important members of this Quality Standard PGI-Corderex are Oviso (94%) and Copreca (5%) (Muñiz, 2005) (Table 1).

Table 1. Certifications evolution of the Quality Standard P.G.I.-Corderex

	2003	2004	2005
Registered farms	361	380	402
Registered livestock (10^3)	333	342	362
Slaughtered lambs PGI (10^3)	31.3	31.9	33.8
Certified carcass (10^3)	26.4	25.5	27.0
Authorized slaughterhouses PGI	4	4	4
Oviso (10^3 and %)	20.3 (77%)	19.7 (78%)	19.0 (80%)
Copreca (10^3 and %)	1.3 (5%)	1.8 (6%)	1.6 (7%)
Others (10^3 and %)	4.8 (18%)	4.5 (16%)	3.2 (13%)

The certification criteria of the QS Corderex overpass the standardised levels of the biggest corporations (Sereno, 2002). In addition, it follows the requirements of a product framed by a PGI, certifying the QS as a certifier body PGI-Corderex (EN45011).

Quality Standard PDO (Protected Designation of Origin) Cheese

Extremadura's ovine cheese production is a wonderful complement to meat production and it is linked to the PDOs. With these specific structures, Extremadura's cheese production is placed in the producer sector or in small in-house companies, without an expectation from big external milk companies.

The production of cheese and La Serena's soft cheese (Torta de la Serena) covers 21 municipalities of Badajoz, affecting 100,000 merino sheep and 15 cheese corporations that make 200,000 kg of certified cheese every year, and 100,000 with other brands (Table 2). The rest of the producing sector is formed by 7 cheese corporations with 250,000 kg of non-certified handmade cheese a year (Morillo, 2005). Around 5% of the production is exported (Germany, USA, Japan), the rest concentrates its commercialization in Madrid (25%), Barcelona (10%) and above all in Extremadura (60%), especially in regional selling (30%). However the certified production is widely commercialized in national markets (80%) instead of regional markets (20%). The distribution in large shopping centres is overwhelming (70%), face to restaurants (15-10%) and specialised shops (10-15%).

Table 2. PDO ovine certification evolution in Extremadura

	2002	2003	2004	2005	2006†
Queso Serena PDO (10^3 kg)	167.9	178.2	189.7	191.0	200.0
Registered cheese corporations	16	16	16	15	15
Queso Casar PDO (10^3 kg)	147.1	249.5	291.4	310.0	350.0
Registered cheese corporations	8	12	12	14	15

†Estimate.

The production of soft cheese (Torta del Casar) covers 36 municipalities of Cáceres, affecting 40,000 entrefino or merino sheep and 15 cheese corporations that make 350,000 kg of certified

cheese every year, and 10,000 with other brands. The rest of the producing sector is formed by 2 cheese corporations with 20,000 kg of non-certified handmade cheese (Núñez, 2005). The biggest part (80%), is destined to distribution in Madrid (30%), Bilbao (30%) and Barcelona (20%), the rest is sold to specialised shops in Extremadura (8%), Madrid (8%) and Catalonia-East (4%).

The commercialization is nowadays one of the main structural limitations due to its quality characteristics. The shopping corporations with a bigger presence of these cheeses are Carrefour (50%), Makro (20%), Corte Inglés (10%), Mercadona (10%) and Eroski (5%).

Wool production's value

A Project started up in 2002 to value Extremadura's wool production, concentrating 2 million kg of non cleaned fleece. This aspect is determinant for the value of a product, which is not currently profitable, and the fact of inserting a so debilitated ovine production during the last decades, but with a high intrinsic value, in the transformation and marketing processes.

Extremadura sells washed and combed wool after a controlled shearing and classification process. Thus the producers get typified, pressed and packed wool. Nowadays 78% of the classified wool can be transformed into length combed products (52-55 mm), although with a micronage of 23-25 mm. The 50% is commercialized as non cleaned fleece: domestic trade (20%), Italy (10%), India 10%) and Morocco (10%). The other half is commercialized as washed-combed-carded wool: Turkey (20%), Italy (15%), Spain (10%) and Morocco (5%).

Uncertainties

(i) The future of the ovine sector in the EU in the short term is complicated and in the context of expansion, demand shows that general trends are not promising, despite the positive image of the ovine meat. A huge commercial push is necessary to promote consumption. A little further into the future, the survival of the ovine sector in the EU will depend on three aspects: increasing exports from Eastern countries to the EU, once issues of sanitary regulations have been resolved; difficulties in continuing to negotiate downward the self-limitation agreements with Australia and New Zealand, and the influence of the recent agreements of the CMO and the WTO on meat markets.

(ii) The choice of a single incentive, decided during the last CMO reform, may favour the sector because it allows decisions to be taken on improving efficiency and exploitation benefits, regardless the bonus subsidy. The lack of appeal in continuity through generations could soon provoke a serious crisis in the sector, worsened by the effect of partial dissociation of the incentive with respect to production, which could cause an increasing number of farmers to leave the market without the support of a new generation to replace them.

(iii) The latest food scandals have undermined a consumer's confidence in an expensive product, although the ovine sector has always avoided these problems in the past. Europe requires a sector that fully abides by and fulfils all of the sanitary regulations linked to an eco-condition regulated by the single incentive.

(iv) The new organization of the European market after the last enlargement, whose new set-up now includes countries with a long tradition of ovine meat production (Hungary and Poland), currently with little purpose. The producing sector must lead production towards a trade strategy to obtain high quality products, capable of meeting the demand of various customers, and must be concern of the aspects linked to food safety. The sector must be creative and able to offer more elaborate products, of greater added value, as it is the case with other products.

(v) Extremadura's ovine production must face this situation by following a plan of action that promotes domestic consumption and increases its presence among other European markets. In order to achieve this goal, Extremadura's production must grow, adapting the farming systems in conjunction with the competitive European model, separating them from a traditional socio-economic sector focused on gaining profit rather than on becoming technologically efficient. That may lead to a reduction in the number of farmed livestock, but not in the number of heads.

(vi) It is necessary that the marketing campaign will be successful, and that demand will met so that change can inevitably come about. For that purpose, cooperative groups and corporations must try to produce an attractive, new, modern product, appropriate for the different sectors (restaurants, catering, confectionery, families, etc.) and in accordance with the current standards of living.

(vii) This change must present new methods of carving and preparing meat, in order to increase the number of lamb dishes, increasing the number of pieces offered to housewives and restaurants. This progression seems difficult due to the high price of ovine meat in relation to alternative meats, the negative effect of cheaper imports; the negative proportion of meat to bone that reduces its benefit in the customer's eyes; the variation in the final product as perceived by the customer; and the more complex culinary preparation in comparison to other meats.

(viii) This desire to increase consumption is difficult and will be possible if there is a reduction in the cost of lamb meat. For that, it is necessary to reduce some speculative links in the current value chain, without negatively affecting the farming economy.

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Do experts' sensory assessment match consumers' hedonic valuations? An exploratory analysis on cured ham

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SUMMARY – The agrofood industry is interested in the control and conformity of their products to the quality standards while also matching consumers' preferences. Sensory analysis provides a common framework to address both goals. The primary objective of this paper is to investigate to what extent the overall sensory valuations of experts coincide with consumers' preferences; and secondary, which are the sensory attributes that better match consumers' acceptability of cured ham. To fulfil these objectives, a total of 8 samples of cured ham was analysed by 14 trained experts and 213 consumers. The main method applied is Principal Components Analysis (PCA). In order to answer the second objective, we apply an extended PCA on consumers' scores where the attributes' ratings made by experts are also projected. To answer the first objective, the PCA on consumers' scores is compared with the PCA on assessors' scores. Both of them include the attributes' ratings made by experts.

Key words: Principal component analysis, cured ham, trained assessors, consumers, sensory valuations.

RESUME – "L'évaluation des experts coïncide-t-elle avec les évaluations hédonistes des consommateurs ? Une analyse exploratoire du jambon sec". L'industrie agroalimentaire a examiné le contrôle et la conformité de ses produits par rapport aux standards de qualité, en même temps que la satisfaction des préférences des consommateurs. L'analyse sensorielle apporte un cadre commun pour atteindre ces deux buts. Le premier objectif de ce travail est de rechercher quel est le degré de coïncidence entre les évaluations sensorielles menées par les experts et les préférences exprimées par les consommateurs. Et en second lieu, quels sont les attributs sensoriels qui correspondent le mieux à l'acceptabilité du jambon sec évaluée par les consommateurs. Pour accomplir ces objectifs, 8 échantillons de jambon sec ont été analysés par les 14 membres entraînés d'un jury de dégustation et par 214 consommateurs. Les résultats ont été analysés par une Analyse en Composantes Principales (PCA). Afin de répondre au second objectif, on a appliqué une PCA élargie aux résultats des consommateurs, dans laquelle on a aussi projeté les résultats des attributs du jury de dégustation. Pour accomplir le premier objectif, la PCA des résultats des consommateurs est simplement comparée à celle des dégustateurs. Toutes deux ont également pris en compte les valeurs accordées par le jury entraîné aux attributs sensoriels.

Mots-clés : Analyse en composantes principales, jambon sec, dégustateurs entraînés, consommateurs, évaluation sensorielle.

Introduction

The agro-food industry is interested in the control and conformity of their products to the quality standards. In this respect, trained panels may assess the conformity of an array of sensory descriptors to predetermined quality standards. Nevertheless, acceptability by trained panels may diverge from acceptability by final consumers, and matching consumers' needs is a priority in market oriented firms which intend to be successful in the long-run.

Therefore, a first objective of this paper is to investigate to what extent sensory acceptability by a trained panel differs from consumers' global acceptability, and as a second objective, to identify which sensory attributes better match consumers' overall acceptability. Both sensory assessments are referred to cured ham of white breeds.

Spain is the main consumer and producer country of cured ham in the world. Per capita consumption was 4.5 kg in 2003 (Cruz, 2005), and the total production amounted to 249,400 t in

2004. Cured ham accounted for 20% and 37% of processed meat production and sales, respectively (Asociación de Industrias de la Carne de España, 2005).

The European Union defined Protected Designations of Origin (PDO), Protected Geographical Indications (PGI) and Traditional Speciality Guaranteed (TSG) in 1992 [Council Regulations 2081/92 and 2082/92 (European Commission, 2006)]. However, in Spain, as in other Mediterranean countries, these protection squemes were already in place. In fact, the first PDO in ham dates back to 1985, when PDO Teruel was officially recognized. At this moment, besides Teruel ham, there are 5 protected labels by the European legislation, from which three are PDOs on ham from Iberian breed, one is a PGI and another one is Jamón Serrano, which is protected as a TSG. In this research, we were mainly interested in white cured ham because is the one with a larger customer base in Zaragoza, the city where the collection of data took place. Likewise, as this research was part of a pan-European project, some samples of French ham were also considered, in order to assess the acceptability of foreign traditional specialities by Spanish assessors.

Materials and methods

Samples

Eight samples of ham, corresponding to eight different commercial brands, were tasted by both, consumers and trained assessors. These samples differ by the following extrinsic attributes: origin, which could be from Teruel, any other region in Spain and France; quality certified labels: with PDO Jamón de Teruel, with TSG Jamón Serrano, with PGI Jambon de Bayonne, candidate to PGI or without any quality label; and brand, which could be owned either by the producer (firm) or by the distributor. A list of the samples and their extrinsic characteristics is presented in the first three columns of Table 1.

Table 1. Descriptive statistics of the overall acceptability of the samples analysed during the blind test by the consumers and the trained panel

Description of samples					Consumers		Trained panel	
Sample code	Country of origin	Region of origin	Certification	Brand	Mean scale 0-10 (Ranking)	St. deviation scale 0-10	Mean scale 0-10† (Ranking)	St. deviation scale 0-10†
s07	Spain	Undetermined	No	Producer's	6.03 (1)	1.79	6.66 (2)	1.09
s17	Spain	Teruel	No	Producer's	5.77 (2)	1.84	5.55 (3)	1.41
s16	Spain	Teruel	PDO Teruel	Producer's	5.50*** (3)	2.02	6.73*** (1)	1.15
s21	Spain	Undetermined	TSG Jamón Serrano	Producer's	5.32 (4)	1.85	5.06 (4)	1.13
s20	Spain	Undetermined	No	Distributor's	5.03** (5)	1.86	3.05** (7)	1.41
f17	France	Bayonne	PGI Bayonne	Distributor's	4.85 (6)	2.01	4.45 (5)	1.55
f16	France	Aveyron	No	Producer's	4.76*** (7)	2.06	3.51*** (6)	0.94
f15	France	Auvergne	PGI candidate	Producer's	3.92 (8)	2.18	2.89 (8)	0.88

†The trained panel's scale of 1 to 9 has been converted into a scale of 0 to 10.
** and *** indicates significant difference at 1 and 5% level of significance, respectively, between consumers' and trained panel's mean score.

Design of trained assessors' sensory evaluation

Ham samples were assessed by a trained panel of 14 members [who also participated in the research by Cilla et al. (2005)]. To acquaint panellists with product attributes and intensities, six 1 hour training sessions took place over a 4 week period prior to sample testing. During this phase, hams from a variety of manufacturers corresponding to maximum and minimum intensities that might be found for each attribute (1, very low, to 9, very high) were presented to panellists. To test the panel reproducibility, one additional ham was presented at each session. It was the replicate of the second sample of the set and was served as the last of the session. The panel sessions were held at mid-morning, about 3 hours after breakfast. Slices (1.5 mm thick) of the ham portions containing Biceps

femoris (BF), Semimembranosus (SM) and Semitendinosus (ST) muscles were obtained with a slicing machine about 1 hour before tasting, in order to allow slices to reach room temperature (22ºC). They were served on plates to panellists, which were told to taste narrow slice sections including both SM and BF muscles.

A profile of twenty-five sensory attributes of dry-cured ham grouped in appearance, odour, texture, flavour and acceptability was assessed. Attributes were rated on a structured scale of 1 to 9 (1, very low, to 9, very high). About 50 ml of water at room temperature and 20 g of unsalted bread were provided between successive hams. All sessions were done at 22ºC in a sensory panel room equipped with white fluorescent lighting (Philips TLD 86, 5600 ºK, 800 lux). Four hams from different manufacturers were successively evaluated in each of two sessions. The sample order was randomised within sessions. Each ham was evaluated just once by each panellist.

Design of consumers' sensory valuation

A sample of 213 consumers participated in the sensory assessment of ham. The tasting took place in Zaragoza (Spain), at the end of 2004, in a special room available in the two hypermarkets of the collaborative retailer's chain. Tables were facing in the same direction, in order to avoid communication between the participants. The participants were mainly women (67% vs 33% of men); and young and middle age (40% were aged between 36 and 50 years old; and 38% between 51 and 65). Interestingly, all of them declared to be highly involved with ham, as 64% usually consume ham several days in the week, and 26% daily.

Sessions of 45 minutes were organized, in the morning (between 10 am and 1 pm) and the afternoon (between 4 and 8pm) from Monday till Saturday, and along two consecutive weeks in November-December 2004. Each consumer participated in two sessions, in two different weeks, and in each of them, evaluated five cured ham samples in both information conditions, blind and identified, with a break between them of 15 minutes. No more than 12 consumers participated simultaneously. In both sessions, samples were presented monadically, following a complete block design balanced for order effect. The global appreciation was measured on a unstructured continuous scale (0-100 mm) with hedonic references ranging from "I do not like it at all" to "I like it very much". Marks on the scales were converted into scores from 0 to 10. The tasting room kept a temperature of 22º and was provided with white fluorescent lighting. Samples had been kept at environmental conditions for at least half an hour before the tasting, and small slices 1.5 mm thick containing Biceps femoris, Semimembranosus and Semitendinosus muscles were obtained with a slicing machine and were served on plastic plates to participants. Water and toasted bread were available and recommended in order to clean the palate after each plate. In the blind information condition, a three digit code was written on the reverse of the plate. In the identified tasting, the slides projector was used to present the label of each sample, highlighting the brand, origin and the presence or absence of quality certification.

Statistical analysis

Firstly, a descriptive analysis of results was done (means and standard deviations of ratings). Comparisons of means between both groups of individuals, consumers and trained assessors, were made through the Mann-Whitney test. This is a non-parametric test (distribution-free) suitable to compare two independent groups of sampled data.

Secondly, Principal Component Analysis (PCA) was applied to both sets of data in order to investigate the influence of sensory attributes on consumers' and trained panel's sensory preferences. PCA is a multivariate method whose purpose is to summarize most of the original information in a minimum number of factors for prediction purpose (Hair et al., 1998) and permits to represent graphically both, the ham samples and attributes. This statistical method has been broadly used in the literature with satisfactory results. As an illustration, Young et al. (2005) used PCA on trained assessors' sensory valuations of peanuts with different production origins, demonstrating that production origins determine distinctive flavour profiles; whereas Rousset and Martin (1998) separated 6 types of cured hams samples on their sensory properties, as perceived by trained assessors.

Uni- and bi-variate analysis were carried out with SPSS 14.0, while XLSTAT-Pro was used in PCA, and GAUSS 8.0 to represent the joint positioning of brands and attributes on the same map.

Results and discussion

In Table 1 the mean and standard deviation of the ratings assigned by both, consumers and trained assessors, to each of the eight samples are presented. In the case of trained assessors, this is the average score assigned to the attribute "overall acceptability". The trained panel's scale of 1 to 9 has been converted into a scale of 0 to 10 to compare the ratings assigned by consumers and trained assessors. The Mann-Whitney comparison test has been applied to the variables transformed into this common scale.

In terms of overall acceptability, a first difference across groups of assessors is that the trained panel apparently is more demanding, as they assign lower scores to every ham sample than consumers, except for the Spanish ham without certification (S07) and Teruel ham with DO (S16). Secondly, trained assessors also assign a higher score for Teruel ham with DO than Teruel ham without DO, while consumers assign similar scores; and, finally, trained assessors score the distributor's brand noticeably lower than consumers, placing this brand closer to F15 Auvergne ham, which is the least valued by consumers.

According to the Mann-Whitney test, however, only average scores on Teruel ham with DO (S16), the distributor's brand (S20) and Aveyron ham (F16) are accepted to come from different populations, and therefore, average scores are statistically different across groups of assessors at 5% (1% in the case of S20) level of significance.

Sensory profile

Figure 1 shows the first two components obtained by PCA when applied to the average scores on the array of sensory attributes in Table 2 valuated by trained assessors. These two factors account for 52.66% of the total variation, where 29.14% corresponds to the first dimension and 23.52% to the second one.

The first principal component separates the samples according to the country of origin, which in turn appears to be correlated with some appearance, texture and odour attributes. Thus, French hams received high loadings of colour of the SM muscle, colour of the BF, subcutaneous fat, sheen (appearance attributes), pastiness, adhesiveness, hardness, fibrousness (texture attributes), rancid flavour, acorn flavour and pungency (flavour attributes). Whereas Spanish hams got high scores of crumbliness, softness, acorn odour, acceptabilility and flavour, according to this dimension.

The second component separates Auvergne ham (F15) from the other two French samples, and the distributor's brand (S20) from the remaining Spanish samples. F15 is characterised by high levels of crust, saltiness and rancid odour, and low levels of sweetness. S20, on the other hand, is better characterised by high scores of mould odour, colour homogeneity, crust, saltiness and rancid odour, and low scores of flavour, marbling, fat colour and sweetness on this dimension.

According to this figure, crumbliness, softness (texture attributes), sweetness, flavour (flavour attributes), aroma and acorn odour (odour attributes) are the main attributes that drive trained assessors acceptability in a positive direction. Whereas, subcutaneous fat, colour of the BF, crust (appearance attributes), pastiness and adhesiveness (texture attributes) are negatively correlated with trained assessors acceptability.

Consumers' acceptability

Figure 2 shows the first two components obtained by PCA applied to consumers' ratings. In the same map, the positioning of the correlation of sensory attributes (as rated by trained assessors) with the two components are plotted. This is a two-factors solution which accounts for 45.89% of the total variation, where 29.30% corresponds to the first dimension and 16.59% to the second one.

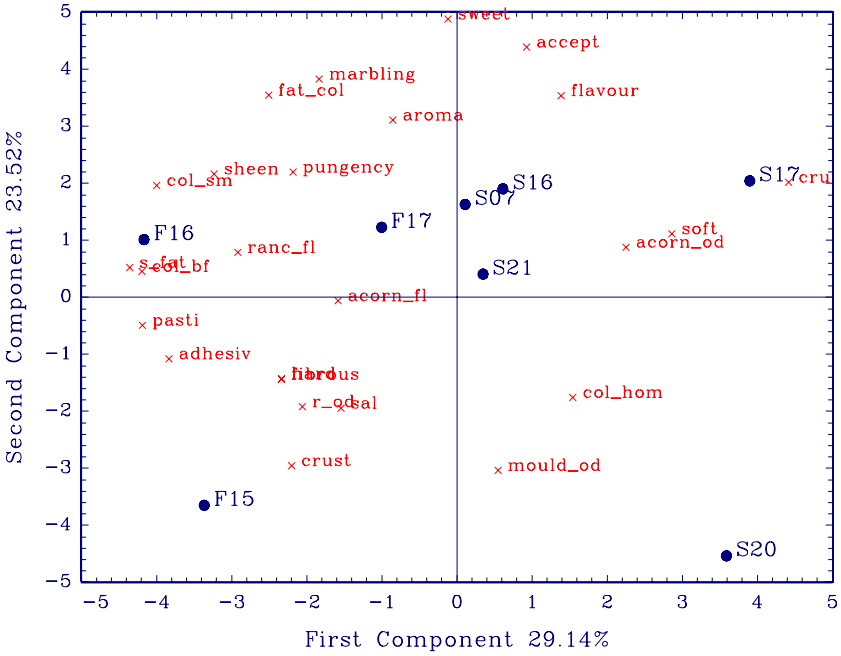

Fig. 1. Principal Component Analysis on assessors' ratings of sensory attributes.

Table 2. Description of sensory attributes

Categories of attributes	Attributes	Short name	Definition
Appearance	Crust	crust	Hardness and darkness of the outer part
	Colour BF	col_bf	Cured colour intensity of BF muscle
	Colour SM	col_sm	Cured colour intens. of SM muscle
	Colour homogeneity	col_hom	Colour homogeneity among muscle zones
	Subcutaneous fat	s_fat	Amount of subcutaneous fat
	Fat colour	fat_col	Colour intensity of subcut. fat
	Marbling	marb	Intramuscular fat infiltration
	Sheen	sheen	Light reflection due to melting fat
Odour	Aroma	aroma	Cured ham aroma intensity
	Rancid odour	r_od	Rancid odour intensity
	Acorn odour	acorn_od	Nut (acorn) odour intensity
	Mould odour	mould_od	Mould odour intensity
Texture	Hardness	hard	Mechanic resistance to mastication
	Softness	soft	Soft and palatable texture in mouth
	Crumbliness	cru	Ability to disintegrate in mastication
	Fibrousness	fibrous	Fibre-like (oriented) hardness
	Pastiness	pasti	Paste-like texture
	Adhesiveness	adhesive	Sticky to teeth and mouth
Flavour	Flavour	flavour	Cured ham flavour intensity
	Saltiness	sal	Salty taste intensity
	Rancid flavour	ranc_fl	Rancid flavour intensity
	Acorn flavour	acorn_fl	Nut (acorn) flavour intensity
	Pungency	pungency	Acrid perception intensity
	Sweetness	sweet	Sweet taste intensity
Acceptability	Acceptability	accept	Overall pleasantness intensity

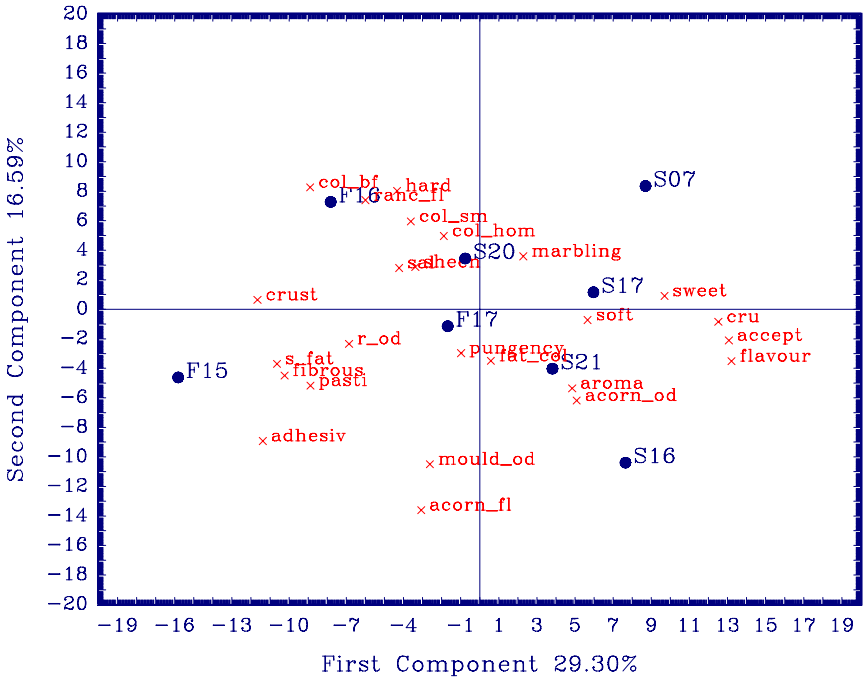

Fig. 2. Principal Component Analysis on consumers' ratings.

The first principal component is correlated with the country of origin, as in Fig. 1, with the exception of S20. French hams are characterized for their adhesiveness, pastiness, fibrousness, hardness and less crumbliness (according to their texture), crust, subcutaneous fat and the colour of the BF (according to their appearance). The second principal component separates samples which differ in their appearance, mainly colour Aveyron ham (F16), distributor's brand (S20), Teruel ham without DO (S17) and producer's brand without DO (S07) from the rest.

Colour of the BF muscle, colour of the SM muscle, colour homogeneity, crust, sheen and marbling have high positive loadings on this dimension, whereas the remaining samples are related to the texture attributes except hardness and also all the odour atributes.

According to this figure, crumbliness, softness (texture attributes), sweetness, flavour (flavour attributes), aroma and acorn odour (odour attributes) are the main attributes that drive consumers preferences in a positive direction. Whereas, crust, subcutaneous fat, colour of the BF, (appearance attributes), fibrousness, pastiness and adhesiveness (texture attribute) are negatively correlated with consumers acceptability.

Conclusions

The overall features of hams, from France and Spain, determine the cured ham sensory valuations. According to the PCA results, both Spanish consumers and trained assessors clearly discriminate between French and Spanish hams, which in turn differ in terms of appearance and texture attributes, and also in flavour attributes for the trained panel.

Spanish consumers place their samples' assessments similarly to trained panel regarding the different attributes, with special emphasis for the most appreciated hams and the French hams.

Besides, both consumers and trained panel mostly agree on the attributes that drive their overall acceptability. In a positive direction, these attributes are crumbliness and softness for texture, for odour these attributes are aroma and acorn odour, and for flavour, sweetness and flavour. Whereas, subcutaneous fat, colour of the BF, crust for appearance, pastiness and adhesiveness for texture are negatively correlated with trained panel and consumers acceptability. That is also the case for fibrousness and consumers acceptability.

In terms of acceptability there are many coincidences between consumers and the trained panel except for three hams, where the Mann-Whitney test shows significant differences, as trained panel assigns a much higher score to the PDO Teruel and lower scores to one Spanish and one French ham. Moreover, both prefer Spanish hams over French hams.

Finally, we need to emphasize that the aim of this study lies on the comparison between trained assessors and naïve consumers of sensory overall acceptability of homogeneous parts of the the same pieces of ham. A typification of cured ham's profiles based on extrinsic common attributes, such as region of origin, quality certified label, brand, is beyond the scope of this paper, which would requiere a significantly larger number of samples.

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Dans quel système de contrôle sanitaire est consommée la viande bovine au Liban : Cas du Grand Beyrouth[1]

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RESUME – La municipalité de Beyrouth s'inquiète de la qualité d'hygiène et de salubrité de la viande produite au niveau des abattoirs et des marchés de gros de la région de "Sabraa". Il se pose ainsi un problème majeur de santé publique, même si pour l'instant aucune épidémie n'a été enregistrée. Nous avons choisi de focaliser notre analyse sur le Grand Beyrouth, la zone la plus pertinente eu égard à notre connaissance de la ville de Beyrouth (municipalité) qui a fait l'objet d'une thèse de Master of Science. La filière viande bovine au Liban est influencée par les mouvements de la croissance urbaine, de la mondialisation. Elle s'organise et se restructure pour répondre à un nouvel environnement socioéconomique. La taille limitée du marché interne ainsi que la politique d'ouverture de son économie ont rendu le marché libanais de la viande plus accessible à la concurrence. D'où l'intérêt d'intégrer la démarche qualité comme un moyen de différenciation des entreprises pour protéger la santé publique et, partant, faciliter la commercialisation de la viande. La fragmentation de l'industrie de la viande, caractérisée par une très grande diversité d'acteurs en interaction dans un petit espace et par sa forme artisanale, sont des éléments explicatifs des faibles performances. Aussi l'insuffisance d'infrastructures et de moyens techniques de transformation, l'absence d'un contrôle de qualité sérieux, le conditionnement manuel, ont entraîné une diminution de la compétitivité du secteur. La structure du marché et le comportement des acteurs ont également conditionné l'environnement sanitaire de la viande. Cette analyse suit la logique de l'approche filière, notamment en traitant toutes les étapes, de l'importation jusqu'à la consommation finale, afin d'apprécier la structure, le comportement des acteurs, ainsi que les opportunités et les contraintes que présente l'environnement pour la qualité sanitaire. Nous avons essayé de situer les moments et les parties des risques sanitaires tout en sachant que ces derniers, selon la littérature, sont présents à tous les niveaux.

Mots-clés : Liban, Grand Beyrouth, viande bovine, qualité sanitaire, stratégie des acteurs, marché, chevillards, abattoir, pouvoirs publics.

SUMMARY – " The health control system in which beef is consumed in the Lebanon: The case of Greater Beirut". The municipality of Beirut is concerned by the health and hygiene quality of meat produced from the abattoirs and wholesale markets of the region of "Sabraa". Thus, a major problem of public health arises, even though at present no epidemics have been recorded. We have chosen to focus our analysis on Greater Beirut, the most pertinent area for our study of the city of Beirut (municipality) that has been the object of a Master of Science thesis. The beef sector in the Lebanon is influenced by urban sprawl and globalisation. It is organised and restructured in order to respond to a new socio-economic environment. The limited size of the domestic market as well as the economic liberalisation policy has made the Lebanese meat market more accessible to competition. Hence the interest in integrating the quality system as a means by which to differentiate the firms in order to protect public health and consequently, to facilitate the marketing of meat. The fragmentation of the meat industry, characterised by a very wide diversity of stakeholders interacting in a small area and as well as their artisanal nature, are elements that explain such a weak performance. Likewise, insufficient infrastructures and technical processing equipment, the absence of a rigorous quality control, manual packing, have led to a decrease in competitivity of the sector. The market structure as well as the behaviour of the stakeholders have likewise conditioned the sanitary environment of the meat. This analysis follows the logic of a study of all stages of the production sector, from imports to final consumption, to examine the structure, the behaviour of the stakeholders and the opportunities and constraints that the environment presents for health quality. We have attempted to situate the time and places where health hazards may occur, whilst being aware that the latter, according to the literature, may occur at all levels.

[1] Grand Beyrouth : Environ 22 municipalités sur 1500 km^2, allant de "Nahr El Kaleb" au nord jusqu'à "Nahr El Damour" au Sud, et de "Jebel El Barouk" à l'est jusqu'à la mer méditerranée à l'ouest. Ces agglomérations constituent l'essentiel de l'environnement urbain du Grand Beyrouth et sont sous l'influence directe de la capital Beyrouth. La population dans le grand Beyrouth est évaluée à 2 millions d'habitants en 2003 avec environ 1.700.000 de libanais et 300.000 habitants touristes et étrangers résidents (prévision 2015 : 2.370.525 habitants).

Key words: Lebanon, Greater Beirut, beef, health quality, stakeholder strategy, market, wholesale butchers, abattoir, public authorities.

Introduction

Autour de 20 kg/habitant en 2002, la consommation de viande bovine au Liban est proche de la consommation moyenne de l'Union Européenne et des pays méditerranéens. Cependant, l'étroitesse du pays, le caractère familial et traditionnel qui caractérise l'élevage local, ainsi que la faiblesse des services d'appui technique, mettent le pays dans un état de dépendance avec des importations massives depuis des dizaines d'années (92% des besoins de consommation en 2002).

Face à la complexité croissante de l'offre de produits carnés au Liban, à la mondialisation accrue des provenances, les pouvoirs publics souhaitent analyser les risques éventuels et mettre en place des moyens efficients pour les prévenir. En effet, le consommateur libanais s'attend à ce que la viande qu'il achète ne le rende pas malade. Il revient aux pouvoirs publics d'assurer cette qualité aux citoyens.

D'autre part, Depuis l'adhésion du Liban à l'Organisation Mondiale du Commerce (22 décembre 1994), le cadre réglementaire subit également des tensions résultant des adaptations conformes à la nouvelle donne internationale.

Dans cet article, nous essayerons d'apporter une réflexion sur les limites et les dangers de la situation actuelle, après avoir passé en revue l'état des lieux.

Problématique

Une ceinture d'exploitation d'élevage de boucherie s'est encrée dans le Grand Beyrouth entraînant l'accroissement des quantités commercialisées. Les petites et moyennes unités "artisanales" (au nombre de 29/31) se sont développées très rapidement autour de la capitale Beyrouth en quantité et en potentialités relativement importantes dans la production de viande. Le développement rapide de ce type d'unités a été favorisé par l'augmentation rapide de l'offre de la viande (baisse des prix sur le marché international) qui, en l'absence d'un système de commercialisation organisée, a révélé la nécessité de nouvelles unités de transformation; ensuite, par la facilité de la création d'"ateliers" qui, compte tenu du matériel et des technologies requis, ne nécessitent pas de grands capitaux.

Les grandes unités (2 entreprises), qui sont généralement des propriétaires de fermes associées à un abattoir, éprouvent beaucoup plus de difficultés que les ateliers artisanaux à se moderniser. Le manque de capitaux financiers nécessaires au remplacement de leurs anciennes technologies, les difficultés de gestion, la concurrence des petites et moyennes unités artisanales et la concurrence de la viande congelée, sont les principaux obstacles à leur restructuration. Par ailleurs, l'inexistence pendant très longtemps d'un abattoir d'une capacité suffisante pour approvisionner le Grand Beyrouth et la multiplication des unités d'abattage privées constituent les principales contraintes au contrôle public de la salubrité des viandes. La commercialisation de la viande, sa distribution ainsi que son transport s'effectuent dans des conditions d'hygiène déplorables. Cette désorganisation se développe concomitamment avec le retrait de l'Etat du secteur marchand.

D'autre part, A l'arrivée chez le consommateur, la viande est souvent chargée en différentes flores microbiennes (Abdallah et Sakabedoyan, 2001). Cette contamination est d'autant plus importante en été que les températures extérieures peuvent dépasser 35° plusieurs jours durant. Le cas le plus préoccupant est celui de la charge de Staphylococcus aureus, une conséquence directe d'une contamination humaine.

Paradoxalement, peu d'intoxications alimentaires sont déclarées. En l'absence de données et d'études assez étendues sur ce point précis, on pourrait attribuer ce phénomène au circuit très court de la distribution de la viande bovine depuis son abattage (48 h environ) mais aussi à la rareté des études. La flore la plus dangereuse (flore aérobie) n'a pas le temps de se multiplier.

Méthodologie

Pour le travail du terrain, nous avons d'une part, procédé à la représentation de la filière sous un modèle de collecte d'informations et de données nécessaires pour l'identification des activités et des risques qui y sont liés. D'autre part, nous avons repéré les différents opérateurs intervenant du système de contrôle sanitaire dans la filière et leurs rôles respectifs. Nous avons utilisé pour notre étude un questionnaire qui a été élaboré avec les soins de l'union des syndicats des marchands de bétails du Liban ainsi que des discussions ouvertes avec les différents acteurs de la filière (professionnels et institutionnels, consommateurs et autres intervenant).

La qualité sanitaire de la viande consommée dans le grand Beyrouth

Différents niveaux de risques sanitaires dans la filière viande bovine à Beyrouth

La description de la filière ainsi que les différentes stratégies d'acteurs ont fait l'objet d'un article apart (L'approvisionnement du G. Beyrouth en viande rouge et son état sanitaire). La partie suivante décrit pour chaque maillon de la filière les dangers associés en suivant l'acheminement de la viande depuis le débarquement du bétail vivant au port de Beyrouth jusqu'au différents étalages (boucheries, grandes surfaces) comme le récapitule le Tableau 1.

Tableau 1. Récapitulatif résumant les points critiques selon l'approche HACCP

Etapes	Dangers	Causes
Transport maritime (Importation)	Présence de micro-organismes pathogènes : Salmonella, Staphylococcus aureus, coliformes dont, E. coli	Etat sanitaire douteux des troupeaux (pays de l'est, Inde). Mauvaise hygiène du troupeau
		Durée de transport trop longue. Mauvais nettoyage et désinfection des bateaux et du matériel.
	Présence de micro-organismes d'altération	
	Contaminations croisées	Mauvaise hygiène des bateaux et du personnel. Absence de contrôle systématique à l'arrivée du bétail au port de Beyrouth
Ferme	Contamination fécale : E. coli, Salmonella, Clostridium	Transmission par les mains de l'éleveur, contamination par l'animal lors de son contact avec le sol sans litière
	Contamination par les germes de l'environnement : flores psychotrophes (Listeria, Pseudomonas) et des Entérobactéries, levures et moisissures	Non contrôle des entrées et des sorties à la ferme
		Nettoyage et désinfection inefficaces du matériel
	Multiplication des bactéries sur le matériel de l'élevage	Animaux porteurs sains : Myco, Brucella, Staphylococcus, E. coli; Homme : Staphylococcus, Steptococcus; Environnement : Listeria.
	Contamination par des bactéries pathogènes : Staphylococcus aureus, Streptococcus, Listeria, Mycobacterium tuberculosis, M. bovis, Brucella, E. coli	
		Non respect des temps d'attente des spécialités vétérinaires
Transports (ferme - abattoirs)	Accroissement des flores microbiennes	Températures et humidités trop élevées
	Contaminations par le matériel	Nettoyage et désinfection inefficaces du matériel

Tableau 1. Récapitulatif résumant les points critiques selon l'approche HACCP (cont.)

Etapes	Dangers	Causes
Au niveau des abattoirs	Contamination croisée	Nettoyage et désinfection inefficaces du Matériel. Absence ou mauvaise qualité de contrôle du bétail avant abattage.
	Développement de flore coliforme	Absence de réfrigération
	Contamination par les personnels	Mauvaise hygiène du personnel. Absence de vêtements et de coiffes, Absence d'eau courante et de bonne, qualité hygiénique, Absence de sanitaires et de lavabo, Absence de spécialisation de taches du personnel
	Contamination par les matériels	
	Contamination par l'environnement :	
	Contamination Persistance et multiplication des germes pathogènes et d'altération	Absence ou mauvais nettoyage et désinfection des matériels. Contacts mains viande lors des manipulations. Bâtiments ouverts, mal couverts, proximités de décharge municipale, présence d'insectes volants et de chats.
	Développement des contaminants pendant le transport de la viande par l'eau	Faible disponibilité en eau, absence de traitement ou mauvais traitements de décontamination, absence de contrôle de la qualité micro biologique de l'eau Absence de la chaîne de froid. Absence d'emballages appropriés. Peu ou pas de réfrigération pendant le transport et la distribution
Consommateurs	Toxi-infection alimentaire : syndrome diarrhéique	Absence ou insuffisance de contrôle de la qualité des produits

Tableau réalisé avec la collaboration du Dr. Hilan (IRAL) et les vétérinaires de l'abattoir provisoire de Beyrouth (avril, 2003).

Intervenants dans le contrôle de la qualité sanitaire

Actuellement, différentes structures gèrent la surveillance alimentaire, y compris le secteur de la viande (Fig. 1).

En ce qui concerne la situation du contrôle des denrées alimentaires les principaux problèmes décelés sont les suivants :

(i) Le manque de services d'analyses. Les laboratoires effectuant un contrôle analytique des denrées alimentaires sont : le Laboratoire de "Fanar", le laboratoire central du Ministère de la santé, le laboratoire de l'Institut de Recherches Industrielles (ILRI), les laboratoires privés.

(ii) L'absence de normes officielles. Les textes législatifs régissant l'organisation et le contrôle des denrées alimentaires, pour la majorité anciens, n'ont pas fait l'objet de modification ou d'actualisation. Les textes réglementaires concernant les missions et prérogatives attribuées à chaque service chargé de contrôle des denrées alimentaires sont restés imprécis.

Le recueil complet des normes libanaises et le standard ne sont pas encore achevés. Dans le cas de la viande, les normes élaborées par le Libnor en 1965 se limitent à quelques grandeurs chimiques. La normalisation est sommaire. Il n'existe pas de normes micro biologiques, les entreprises ont établi les leurs d'après des normes américaines ou européennes. Le laboratoire "Fanar", quant à lui, compare les résultats des analyses qu'il pratique à celles du Codex Alimentarius. Un projet de normalisation est à l'étude par le Libnor, basé sur les normes du Codex Alimentarius.

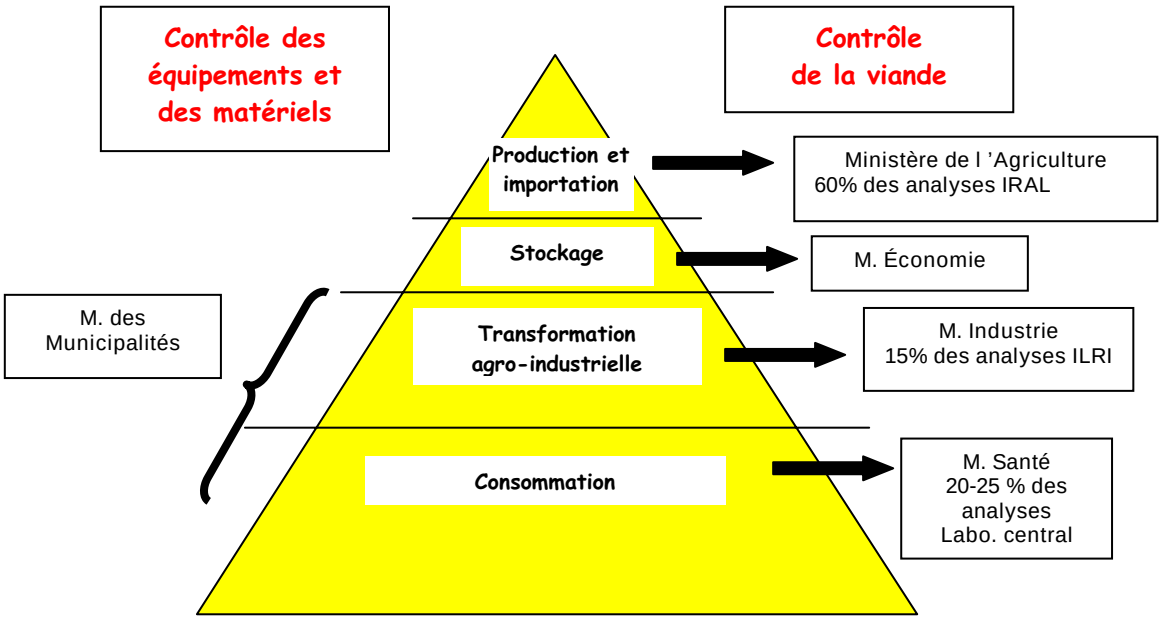

Fig. 1. Diagramme des intervenants dans le contrôle sanitaire de la viande au Liban [source : résultats d'enquêtes août 2001 sous la direction Dr. Hilan K (laboratoire IRAL)].

Analyse et discussion

Il existe au Liban un système de contrôle de la viande rouge, qui aussi peu développé soit-il, protège la population contre les risques de contamination, d'altération ou de mauvaise qualité de leurs aliments. Mais alors où se situe le risque de cette consommation et pourquoi ?

La guerre civile qui a ravagé le Liban, est à l'origine de l'absence de l'Etat dans la vie économique du pays. Malgré l'émission, le 28 décembre 1973, du décret gouvernemental numéro 6821 qui a précisé le rôle du Ministère de l'Industrie dans le contrôle de la qualité et de l'appui technique (Arja et al., 2001), il n'en reste pas moins que tous les règlements qu'il a institués n'ont jamais été appliqués. Pour le contrôle des prix, en s'abstenant de résoudre les problèmes de la filière, l'Etat ne s'est pas doté des moyens qui lui auraient permis de protéger le consommateur et les marchands de bétails. Son intervention s'est limitée à l'institution de taxes et droits d'abattages qui s'appliquent de façon différenciée aux différentes communes d'une même Mohafazat, incitant les acteurs à des pratiques frauduleuses (communes de Beyrouth, Bordj Hamoud et Jbeil).

Le consommateur est mal informé sur la provenance de la viande. Sa sécurité se trouve directement menacée par l'absence d'un contrôle de salubrité de la viande qu'il mange que ce soit au niveau des fermes ou au niveau des unités de transformation. Les fraudes pratiquées par certaines boucheries, notamment en ce qui concerne l'origine du produit (dit "baladi" dans la majorité des cas alors que la marchandise est d'importation ou même non fraîche quand il s'agit de viande hachée), portent préjudice aux bouchers honnêtes et aux marchands du bétail vifs aussi.

L'approche adoptée est à caractère essentiellement répressif, un contrôle exercé essentiellement au niveau du stade produit fini et au niveau de la commercialisation, laissant un vide patent au niveau du contrôle aux stades de production et aux premiers stades de la transformation (abattage). Cette approche ne garantit pas toujours la qualité et encore moins la sécurité puisqu'il s'agit le plus souvent d'un simple contrôle de conformité et de salubrité minima.

Stratégies d'acteurs et risques sanitaires liés à la filière viande bovine

Le problème de la qualité sanitaire de la viande au Liban réside, aussi dans la logique des chefs d'entreprises qui ciblent la croissance et la productivité pour arracher une part importante de marché.

Ils considèrent la qualité comme une contrainte, un coût supplémentaire et ne considèrent pas "productivité" et "qualité" comme complémentaires.

Deux raisons sous-tendent notre inquiétude :

(i) La première est le comportement des consommateurs : avec la reconstruction du pays, le niveau de vie des Libanais augmente de plus en plus. Avec l'urbanisation et le développement des activités économiques (notamment le tourisme), la restauration hors foyer progresse. On voit ainsi une multiplication de comportements de fraudes et l'augmentation des abattages non contrôlés. Le consommateur libanais, en préférant consommer les viandes produites de façon traditionnelle chez le boucher ou chez l'éleveur directement dans les meilleurs des cas et n'ayant pas trop l'habitude d'acheter de la viande emballée, pénalisent le développement de la production industrielle de la boucherie. En outre, ses préférences pour la viande fraîche ne peuvent que favoriser un type de circuit court.

(ii) La deuxième raison est le profil du secteur de la transformation de la viande bovine. Le manque de qualité sanitaire au Liban est un problème que l'on retrouve tout au long de la filière, de la production, à la distribution et à la commercialisation. La salubrité de la viande au Liban est difficile à assurer en l'état, même si aucune maladie ne revêt une forme d'épidémie alimentaire. Le secteur de la transformation de viande bovine est constitué de petites entreprises issues de la pénurie de guerre qui se sont développées dans un environnement libre sans réglementation et dont certaines sont illégales. Ces petites unités n'avaient que pour seul souci l'approvisionnement du Grand Beyrouth en viande bovine et ont complètement délaissé l'hygiène. En revanche, les plus grandes et les plus anciennes entreprises ont conscience de ce problème et affirment garantir un minimum pour garantir l'innocuité de leurs marchandises.

Dans ces conditions, la réussite d'un projet de normalisation pour améliorer la qualité à court terme n'est pas certaine. En l'absence de crédits et de soutien financier, les acteurs de la filière ne sont pas encore prêts à sacrifier une part de leurs ressources pour améliorer leur schéma d'approvisionnement en viande bovine le Grand Beyrouth.

Conclusion

Il est vrai que pour l'application de la qualité, l'intervention de l'Etat est urgente, notamment en amont (installation d'infrastructure, contrôle des fermes et autres), mais l'implication du personnel de l'entreprise depuis le chef jusqu'au simple ouvrier pour gérer et assurer la qualité ne relève que d'une conscience professionnelle et personnelle à travers lesquelles l'entreprise réalise la satisfaction de ses clients, la satisfaction de son personnel, l'intégration dans la vie de la collectivité, et tous ensemble aboutissent durablement à d'excellant résultats opérationnels.

Par ailleurs, la constitution d'associations de consommateurs qui s'occupent de la conscientisation des citoyens aux questions alimentaires et nutritionnelles s'avère indispensable. En plus de leur rôle traditionnel comme groupe de pressions sur l'Etat, ces associations devraient aider le consommateur à exercer pleinement son rôle d'acteur économique.

Une certaine forme d'adaptation du consumérisme pourrait être une solution. En effet, au sein de la société de consommation, le consumérisme est une "force émergente" dont l'objectif général est de promouvoir la fonction de consommation dans la nation et sur le plan international. Il ne s'agit point d'"apprendre à acheter" au consommateur, mais de lui donner un rôle dans la définition des objectifs mêmes de l'appareil de production-distribution.

Les faibles capacités des services publics à effectuer des contrôles auprès des acteurs privés sont liées aux manques de normes nationales précises, et de moyens financiers et humains qualifiés. Les normes internationales qui figurent dans les textes, aujourd'hui, semblent être lourdes à la réalisation.

Aussi, plusieurs travaux d'analyses microbiologiques menés dans les PVD ont souligné l'inadéquation des normes internationales dans le contexte des entreprises artisanales (FAO, 1999) qui dans le cas du Liban, assurent totalement l'approvisionnement du grand Beyrouth en viande rouge. Il convient donc de définir de nouvelles normes, basées sur un consensus social[2], respectueux des conditions libanaises pouvant aider les petites entreprises à améliorer leurs pratiques.

Enfin, pour les entreprises qui ont les moyens de valoriser leur production par l'autogestion de la qualité, les services publics devraient s'intéresser à la promotion de ce type de produits par des marques commerciales.

Dans l'avenir proche, les débats pourraient porter sur la reconnaissance de la diversification des produits et de leurs origines, à condition que la recherche puisse apporter des éléments plus précis sur les caractéristiques objectives des différents produits (frais, surgelés, congelés, origine d'importation, etc.) et sur les pratiques de la consommation.

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[2]Le Conseil National de l'Alimentation (juin 2002) définie la qualité comme étant une construction sociale. Pour réaliser un ensemble d'objectifs, génériques et spécifiques, dans les économies contemporaines, les acteurs privés et les pouvoirs publics ont été amenés à négocier les définitions et les conditions de la qualité à atteindre.