Chapter

Gascon Pig

Marie-José Mercat, Bénédicte Lebret, Herveline Lenoir and Nina Batorek-Lukač

Abstract

The present chapter aims to present history and current status of Gascon pig breed, one of the local pig breeds investigated in the project TREASURE. This French autochthonous breed of pigs, which almost disappeared, now enjoys a new boom. The quality of its product is recognized by the consumers and by official quality labels (Protected Designation of Origin). Exterior phenotypic characteristics of the breed, geographical location, production system and main products are described. Reproductive performance data available in the literature and estimated from the LIGERAL database (herdbook) are presented. Literature data on production traits are also summarized for growth (early, middle, late and overall growth), feed intake, body composition and carcass traits. Meat quality traits (pH, colour, intramuscular fat content and composition) and fat tissue characteristics (fatty acid profile) are also described. Studies on Gascon pig breed are scarce and variability between studies, especially regarding productive traits, can be explained by differences in production systems, feeding regimes and feed composition according to studies. Nevertheless, the current review gives updated insights into the reproduction, production and quality traits of this local pig breed.

Keywords: traditional European breed, TREASURE, productive traits, phenotype, France

1. History and the current status of the breed (census)

The Gascon is a rare breed of domestic pig which has survived at the foot of the Pyrénées mountains in the southwest of France. This pig breed was already present in this region from ancient times: traces from the Gallo-Roman period were found. Like many other local breeds, its production declined during the second part of the twentieth century up to only 34 sows and 2 boars registered in 1981. However, a group of farmers, pork butchers and processors, with the help of technical advisors, gathered together with the objective of reviving the Gascon breed and its high-quality products. A breed conservation programme was developed with the help of IFIP and local agricultural chamber. Census of Gascon pig breed and its evolution over the last 20 years are presented in **Figure 1**. Presently there are 64 registered farms of Gascon pigs with 1423 breeding sows and 177 breeding males in the latest available status (year 2017).

Farms are either related to the Association des Eleveurs de Porcs Gascons des Hautes Pyrénées (AEPGHP), adhering to the Consortium du Noir de Bigorre (CNB), or the Association Nationale de Sauvegarde du Porc Gascon (ANSPG) or

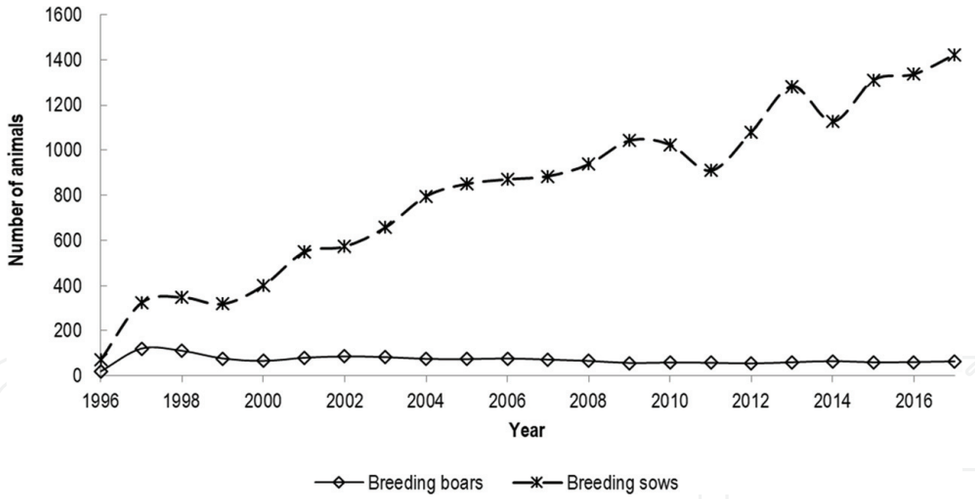

Figure 1.
Census of Gascon pig breed, presenting number of sows and boars per year, starting with the year of herdbook establishment.

unrelated to any breeder group. AEPGHP represents 77% of the sows recorded in the LIGERAL herdbook.

In 2002, the CNB initiated process for further registration of their products as Protected Designation of Origin (PDO) quality label. With the Gascon breed, the CNB has progressively developed based on the production of local, high-quality pork products and vigorous efforts to communicate on their local pig production system as well as the high eating quality of their products. In 2015 the "Noir de Bigorre" fresh loin and "Noir de Bigorre" dry-cured hams, produced from Gascon pigs, obtained the French AOC (Appellation d'Origine Contrôlée) label, which is the national step towards registrations as PDO at European level. Both products obtained PDO registration in September 2017.

2. Exterior phenotypic characteristics

The Gascon pig breed morphology information is summarised in **Table 1**. The Gascon is a resistant, slow-growing breed able to live outdoors all year round. As described in the breed standard, animals have a cylindrical shape with thin and tough limbs. They have black skin and are black wire-haired with thicker hair along the dorsal stripe finishing in a swirl on the rump beside a cowlick on the top of the

Measurement (average)	Adult male	Adult female
Body weight (kg)	300	250
Body length1 (cm)	120	120
Head length (cm)	40	—
Ear length (cm)	20	—
Chest height (cm)	40	—
Height at withers (cm)	75	75
Number of teats	≥12	≥12

[1]*Measured from the tip of the nose to the starting point of the tail.*

Table 1.
Summary of morphology information on Gascon pig breed.

Figure 2.
Gascon sow with piglets (photo credit of consortium noir de Bigorre).

Figure 3.
Boar of Gascon breed (photo credit of consortium noir de Bigorre).

back. Gascon pigs face is characteristically pointed "like a mole" with narrow ears close to the base, slightly tilted over the eyes with length equal to half the length of the head (**Figures 2** and **3**).

3. Geographical location and production system

Gascon pigs produced in the local production system (Noir de Bigorre pork chain) are raised outdoor in extensive conditions at least during a 6-month finishing period. They consume large quantities of grass and fruits (acorns, chestnuts) depending on the season.

The CNB breeding area and pig production system are defined in the AOC specifications [1]. The ANSPG area is wider but predominantly located in the southwest of France, the cradle of the breed.

To benefit from AOC/PDO Noir de Bigorre registration, pure Gascon pigs must be born, reared and slaughtered in the specified geographical area. Pigs (either castrated males or females before any lactation) are generally born and kept indoors on straw with possible outdoor access, up to a maximum of 6 months of age. They are then placed until slaughter on natural or cultivated grassland (max. 20 pigs/ha) providing various grass species or leguminous plants, with possible access to a forest plot (e.g. acorns and chestnut). Plot lands must be approved by the authorities responsible for quality sign management and control. In addition to natural feeding resources, pigs are fed with complementary food based on a minimum of 70%

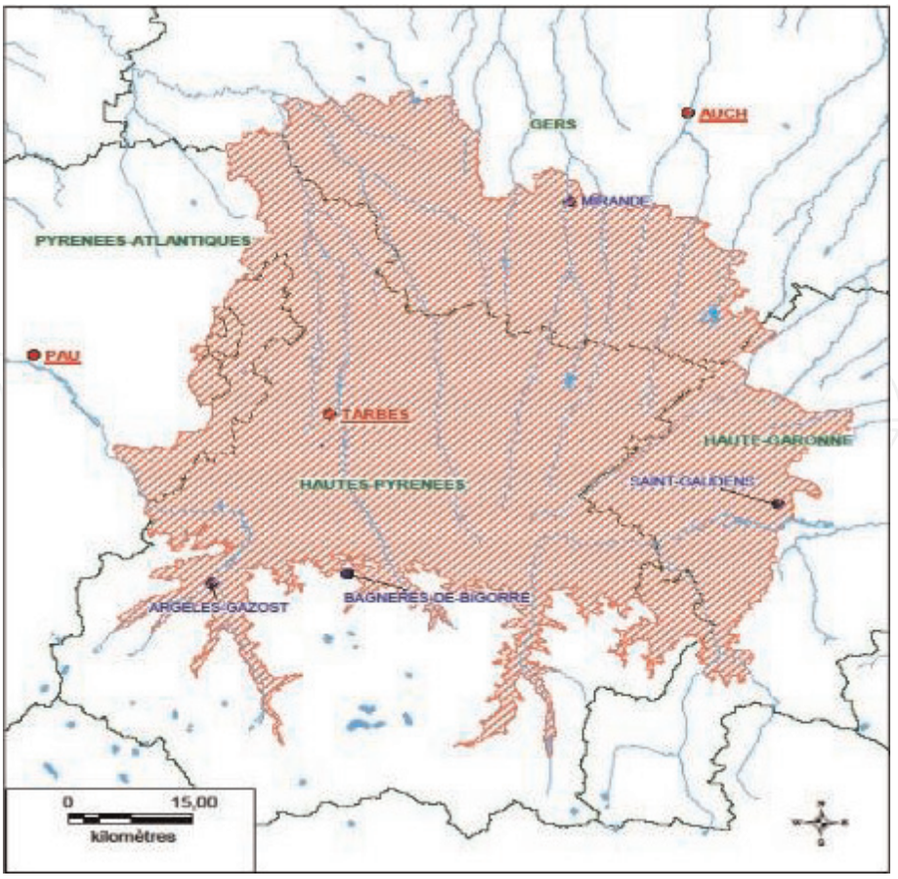

Figure 4.
Geographical localisation of the production of Gascon pigs for the noir de Bigorre protected designation of origin in France (https://www.inao.gouv.fr/fichier/CDCPorcNoirDeBigorre2016.pdf).

cereals (wheat, oat, barley, rye and triticale) produced on the geographical area, with potential protein resources (faba beans, peas, rapeseed or sunflower meal), minerals and vitamins. Maize, sorghum and sunflower are not allowed. The farmers themselves often produce complementary food.

Pigs are slaughtered at a minimum of 12 and maximum of 24 months of age. Specifications for carcasses are a minimum of 100 kg of hot carcass weight, minimum 25 mm of fat depth over the *gluteus medius* muscle (ZP point) and 45 mm of muscle depth (ZP muscle). Whole traceability is guaranteed for pigs and carcasses. Minimum green ham weight of 10 kg and ripening duration of 20 months are required for AOC/PDO Noir de Bigorre hams (**Figure 4**).

4. Organisations for breeding, monitoring and conservation

All animals, boars, sows and piglets, are individually identified and recorded in the LIGERAL herdbook. An accreditation committee, composed of an expert and the technician in charge of following-up the farms, validates each potential breeder considering the breed standard, the teats number (minimum of 12 functioning teats) and the inbreeding coefficient. Only pure-bred reproduction is performed using 100% natural mating. Usually, farms self-renew their sows and buy boars. Replacement breeding policy is based on relationship coefficients estimated by IFIP and on the number of live animals per family (sows) or line (boars). One farm belonging to the AEPGHP is dedicated to boars rearing from 2 to 3 months of age (25–30 boars a year). Number of breeders per family or line, reproductive performances and inbreeding are reviewed at least once a year. More

Name of organisation	Address	Web or e-mail address
Association des éleveurs de porcs gascons des Hautes Pyrénées (linked to the Consortium du Noir de Bigorre)	Pyrène Aéropôle, 65290 Louey, France	—
Consortium du Noir de Bigorre	Pyrène Aéropôle, 65290 Louey, France	http://www.noirdebigorre.com/
Association Nationale de Sauvegarde du Porc Gascon (ANSPG)	—	anspgascon@gmail.com
LIGERAL—c/o IFIP	La Motte au Vicomte, BP 35104, 35651 Le Rheu cedex, France	www.asp.asso.fr

Table 2.
Contact details of breeding organisation for Gascon pig breed.

complete analyses of the genetic variability based on probabilities of gene origin studies are performed occasionally [2]. AEPGHP and ANSPG adopt common decisions related to the management of the breed in a single pilot committee. There are common people in the accreditation committee and there are exchanges of animals occasionally. Besides, Gascon semen doses are preserved in the French National Cryobank which contains semen collected specifically in the 1990s and the beginning of the 2000s. This heritage material is only dedicated to breed preservation (**Table 2**).

5. Productive performance

5.1 Reproductive traits

Basic data obtained on reproductive traits in this review are presented in **Table 3**. Averages are calculated from data registered in the LIGERAL database. For the last available 5-year period (2012–2016), the age of sows at first parturition is 17 months [11]. On average, sows of Gascon pig breed have 1.7 litters per year with 8.1 piglets born alive. The death rate of piglets until weaning in the considered recent 5-year period is correct and averages 9.8% [11]. Published data are also synthetized in **Table 3**. Without selection on reproductive performances, litter size (born alive and weaned piglets) tended to degrade between 1997 and 2003. Then a slight improvement was observed until 2007 [8]. Most recent data obtained within TREASURE project confirm that litter size seems now stable [10]. Duration of the lactation is prolonged in comparison with modern intensive systems to 38 days, which is also reflected in the prolonged farrowing interval, 214 days on average. Thus, it can be concluded that Gascon pig breed has moderate fertility compared to the most prevalent breeds.

5.2 Growth performance

Basic data on growth performance obtained in this review are presented in **Tables 4** and **5**. Due to big differences between studies with regard to the live weight range covered, we defined the stages for growth performance as lactation (regardless of how long it was), growing stage (from weaning to approximately 30 kg live body weight) and early, middle and late fattening stages

Reference	Sow age at first parturition (mth)	Litters per sow per year[1]	No. of piglets alive per litter	Mortality at weaning (%)	Duration of lactation (d)	Farrowing interval (d)	Sow age at culling (mth)
[3]	—	—	9.4	11.8	—	—	84
[4]	—	—	9.0	42.2	—	—	—
	—	—	8.2	25.6	—	—	—
	—	—	8.5	27.1	—	—	—
	—	—	9.6	26.0	—	—	—
[5]	—	1.4	8.0	15.0	—	261	—
[6]	—	—	8.1	14.8	—	—	—
[7]	—	1.5	8.2	15.9	—	243	—
[8][2]	—	1.6	8.0	11.3	—	228	—
[2]	—	—	8.0	11.3	—	—	—
[9]	—	—	8.1	11.1	—	—	—
[10]	17.0	1.6	8.1	9.0	37	228	50
[11][3]	**17.4**	**1.7**	**8.1**	**9.8**	**38**	**214**	**49**

No. = number, mth = month, d = days.
[1]Litters per sow per year calculated as the average number of litters per sow having at least one litter in the year.
*[2]Least squares means with a GLM model including breed (5 local breeds), parity season as a fixed effect, breed*parity interaction, the age of the sow and birth year as a covariate.*
[3]Five-year average value from herdbook data (LIGERLA database between 2012 and 2016).

Table 3.
Summary of collected literature data on reproduction traits of Gascon pig breed.

Reference	Feeding	No. of animals	ADG fattening[1]				ADG Birth slaughter
			Early	Middle	Late	Overall	
[4]	—	—	—	—	—	529	—
	—	—	—	—	—	500	—
	—	—	—	—	—	498	—
	—	—	—	—	—	384	—
[6, 12]	—	16	—	—	362	455	—
	—	18	—	—	—	342	—
[13, 14]	Ad lib	24	—	—	—	537	—
[15]	Semi	39	336	486	337	384	—
[16, 17]	Semi	8	408	—	—	439	378
	Semi	18	458	387	432	428	409
	Semi	7	346	—	—	460	424
	Semi	16	502	462	346	409	389
[16]	Semi	8	—	—	—	469	455
	Semi	20	—	—	—	432	414

No. = number; ADG = average daily gain in g; Ad lib = ad libitum feeding regime; Semi = semi-*ad libitum feeding regime.*
[1]ADG in a period of fattening is reported for early, middle and late fattening stages estimated between approximately 30 and 60 kg, 60 and 100 kg and above 100 kg live body weight, respectively. Sometimes the source provided only the overall growth rate for the whole studied period (in that case defined as overall).

Table 4.
Summary of collected literature data on growth performance in Gascon pig breed.

estimated between approximately 30 and 60 kg, 60 and 100 kg and above 100 kg live body weight, respectively. Sometimes the source provided only the overall growth rate for the whole fattening stage (defined as overall). It should also be noted that a big part of the collected studies simulated practical conditions of the production systems used and that only a smaller part of the studies aimed at evaluating the breed potential for growth. In the considered studies, data for performance in the stage of lactation and growing stage are missing. The early, middle, late and overall fattening stage is characterised by slower growth than "modern" selected pigs and big heterogeneity for each of these growing stages as well as for the overall growing-finishing stage (342–537 g/day), related to the fact that this review comprises studies where different systems and feeding levels were considered. In the context of the evaluation of growth performance, it is also of interest to observe the extreme values, because it can be assumed that the maximum figures exhibit the growth potentials of Gascon pigs in ad libitum conditions of feeding (≈537 g/day in overall fattening stage).

In considered studies, the information on feed intake and feed nutritional value were rather scarce (max n = 9 studies), which limits the evaluation of growth potential. Moreover, in some studies, values correspond to the daily feed distributed but not the actual feed intake due to waste of feed by the animals around the feeder. Average estimated daily feed intake increased from 2.5 kg/day [15] in the middle growing stage to max of 3.6 kg/day [16, 17] in the overall fattening stage, above values being probably overestimated and corresponding to daily feed distributed, whereas feed "intake" in overall fattening stage averaged 3.0 g/day (n = 9 studies).

Reference	Feeding	ME content of feed (MJ/kg)	CP content of feed (%)	No. of animals	ADFI fattening[1]			
					Early	Middle	Late	Overall[2]
[4]	—	—	—	—	—	—	2.5	—
	—	—	—	—	—	—	—	2.5
	—	—	—	—	—	—	—	2.4
[6, 12]	—	—	—	16	—	—	2.5	—
	—	—	—	18	—	—	2.0	—
[13, 14]	Semi	12.6	17.0	24	—	—	—	2.4
[15]	Semi	11.5	—	39	—	2.5	2.5	—
[16, 17]	Semi	—	9.9	8	—	—	—	3.7[2]
	Semi	—	12.3	18	—	—	—	2.7
	Semi	—	13.4	7	—	—	—	4.2[2]
	Semi	—	12.8	16	—	—	—	2.6
[16]	Semi	—	12.9	8	—	—	—	3.9[2]
	Semi	—	13.1	20	—	—	—	2.4

No. = number, ADFI = average daily feed intake in kg/day, Semi = semi-*ad libitum feeding regime, ME = metabolisable energy, CP = crude protein.*
[1]ADFI in period of fattening is reported for early, middle and late fattening stages estimated between approximately 30 and 60 kg, 60 and 100 kg and above 100 kg live body weight, respectively. Sometimes the source provided only the overall daily feed intake for the whole studied period (in that case defined as overall).
[2]Values in studies from refs. [16, 17] that are rather high correspond to average daily feed supply but not actual daily feed intake.

Table 5.
Summary of collected literature data on average daily feed intake (in kg/day) in Gascon pig breed.

5.3 Body composition and carcass traits

Basic data obtained in this review with some of the most commonly encountered carcass traits that could be compared are presented in **Table 6**. In considered studies, pigs of Gascon breed were slaughtered between 183 and 442 days of age (n = 11 studies) and between 98 and 181 kg live weight (n = 16 studies) and had a dressing yield around 80% (n = 8 studies). The backfat thickness measured at the level of the *gluteus medius* muscle (official site for fat depth measurement in the Noir de Bigorre AOC specification) was high (over 46 mm, n = 8 studies) but variable (reported average value calculated within studies between 38 and 49 mm). Backfat thickness was over 38 mm at the level of the last rib (n = 6 studies) and 42 mm (n = 6 studies) at the level of the first rib (neck). In the studies undertaken within TREASURE project [16, 17], muscle thickness measured at ZP point (minimum depth from the vertebral channel to the cranial end of the *gluteus medius*) was 69 mm on average. Muscularity assessed as lean meat content was between 35 and 40% in the only two available studies [14, 15]. Overall, values of fat and muscle depths indicate lower muscular development and greater carcass fatness compared to modern breeds, which can be explained by the absence of selection against fatness and on carcass muscle content in the Gascon breed. Variations observed

Reference	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Lean meat content (%)	Backfat thickness (mm)			M[1] (mm)
							S[2]	At first rib[3]	At last rib[4]	
[3]	17	—	166	—	—	—	—	—	43	—
[4]	—	253	100	—	—	—	—	—	—	—
	—	183	98	—	—	—	—	—	—	—
	—	—	113	89	79.2	—	—	—	—	—
[6, 12]	8	—	100	—	—	—	—	—	—	—
	16	—	146	—	—	—	49	—	—	—
	18	—	146	—	—	—	38	—	—	—
[13, 14]	24	283	125	—	—	40.0	—	—	46	—
[15]	39	407	140	116	83.2	35.0	—	—	—	—
[16]	8	377	173	138	80.0	—	47	46	66	69
	20	435	181	144	79.4	—	46	38	58	68
[16, 17]	8	410	156	123	78.7	—	49	54	47	68
	18	416	171	138	81.0	—	45	59	42	68
	7	388	166	133	80.0	—	46	44	57	71
	16	424	166	135	81.4	—	46	39	56	71
[18]	12	442	170	—	—	—	—	—	—	—

No. = number, BW = body weight; CW = carcass weight.
[1]*M muscle thickness measured according to ZP method (from the vertebral canal to the cranial edge of the* gluteus medius *muscle (mm)).*
[2]*S backfat thickness measured according to ZP method (above the* gluteus medius *muscle (mm)).*
[3]*Measured at the level of the first rib (first thoracic vertebra).*
[4]*Measured at the level of the last rib or reported as the average of measurements taken along the carcass.*

Table 6.
Summary of collected literature data on body composition and carcass traits in Gascon pig breed.

Reference	No. of animals	pH 45	pH 24	CIE[1]			IMF (%)	FA composition of IMF (%)				FA composition of BFT (%)			
				L*	a*	b*		SFA	MUFA	PUFA	n6/n3	SFA	MUFA	PUFA	n6/n3
[3]	17	—	5.68	—	—	—	—	—	—	—	—	—	—	—	—
[4]	—	6.40	5.92	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	5.70	38	6.4	3.5	—	—	—	—	—	—	—	—	—
	—	—	5.70	41	6.8	4.4	—	—	—	—	—	—	—	—	—
	—	—	5.70	42	6.7	4.5	—	—	—	—	—	—	—	—	—
[6, 12]	8	—	—	—	—	—	3.2	—	—	—	—	46.6	43.5	9.9	—
	16	6.41	5.69	46	10.1	—	—	—	—	—	—	—	—	—	—
	18	6.37	—	—	—	—	—	—	—	—	—	—	—	—	—
[13, 14]	24	—	5.73	—	—	—	3.3	38.1	52.2	9.7	1.1	39.8	50.2	10.0	—
[15]	39	—	5.64	40	6.7	4.2	—	—	—	—	—	42.6	47.6	9.8	—
[16]	8	6.34	5.57	44	9.7	3.5	2.2	—	—	—	—	39.6	54.2	6.2	6.4
	20	6.56	5.68	43	9.3	3.2	2.6	—	—	—	—	40.5	53.4	6.0	5.6
[16, 17]	8	6.64	5.52	48	11.1	4.7	2.7	—	—	—	—	39.5	52.9	7.6	6.1
	18	6.50	5.57	46	10.4	4.2	2.4	—	—	—	—	39.0	54.0	7.0	6.4
	7	6.74	5.55	45	10.0	4.0	2.5	—	—	—	—	39.2	53.7	7.1	5.5
	16	6.76	5.73	42	9.5	3.2	2.0	—	—	—	—	39.9	53.1	6.9	5.8
[18]	12	—	—	—	—	—	2.6	—	—	—	—	—	—	—	—

No. = number, pH 45 = pH measured approximately 45 min post-mortem*; pH 24 = pH measured approximately 24 hours* post-mortem*; IMF = intramuscular fat; FA = fatty acid; BFT = backfat tissue; SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; n6/n3 = the proportion between n-6 and n-3 polyunsaturated fatty acids.*
[1]CIE = objective colour defined by the Commission Internationale de l'Eclairage; L greater value indicates a lighter colour; a* greater value indicates a redder colour; b* greater value indicates a more yellow colour.*

Table 7.
Summary of collected literature data on meat and fat quality in Gascon pig breed.

especially regarding backfat thickness are also a consequence of the wide range of final live weight of pigs and different feeding regimes and production practices applied in the considered studies.

5.4 Meat and fat quality

Basic data obtained in this review with some of the most commonly encountered meat and fat quality traits measured in the *longissimus* muscle that could be compared are presented in **Table 7**. In the studies reporting meat quality of Gascon pigs, pH measured in the *longissimus* muscle at 45 min and 24 hours *post-mortem* varied between 6.34 and 6.76 (n = 9 studies) and 5.55 and 5.92 (n = 14 studies), respectively. These are satisfactory values that indicate lack of major quality defects such as PSE or acid meat. The intramuscular fat content ranged between 2.0 and 3.3% (n = 9 studies). Colour measured in CIE L*, a* and b* colour space denotes a visually red colour and moderate lightness of the meat, which are satisfactory regarding appearance of the meat. In the only available study, SFA, MUFA and PUFA contents of intramuscular fat in the *longissimus* muscle were 38.1, 52.2 and 9.7%, respectively. Fatty acid composition of backfat lipids (n = 9 studies) shows high proportion of MUFA (average values between 47.6 and 54.2%) and SFA (average values between 39 and 46%) and low proportion of PUFA (less than 8% in 6 out of the 9 available studies) as compared to fatty acid profiles of backfat generally found in modern pig breeds [19]. The high proportion of MUFA and low proportion of PUFA of backfat lipids from Gascon pigs can be explained by their high genetic potential for lipid deposition together with their high energy intake during finishing period, leading to high oleic acid production from lipogenesis, the PUFA resulting only from exogenous supplies in pigs [20].

6. Use of breed and main products

The French autochthonous pig breed Gascon is valorised in high-quality fresh pork and pork products, mainly by the CNB but also by independent producers. The local production system associated to the know-how of producers that lead to typicity of pork and pork products has now been recognised at French and European levels through recent obtaining of AOC and PDO official quality labels for Noir de Bigorre fresh pork and dry-cured hams. Indeed, the characteristics of the Gascon pigs that exhibit a low growth potential (low growth rate) and a high carcass fatness, associated with the extensive production system with access to local feeding resources, allow for the development of the intrinsic qualities of muscle and fat tissues that lead to high eating qualities of the products [19, 21]. Mainly, the meat of Gascon pigs exhibits a dark red colour with low lightness, low rate and moderate amplitude of *post-mortem* pH decline, low drip loss and adequate IMF content, as well as white and firm backfat with high monounsaturated fatty and low polyunsaturated fatty acid proportions. These properties are favourable for the pleasant appearance and high tenderness and juiciness of the fresh meat, as well as for the processing of dry-cured products with long ripening duration leading to high tenderness and development of specific flavours.

Dry-cured ham is the main and most “valued” product from Gascon pigs. Other main products are listed in **Table 8**. To still improve the intrinsic qualities (tenderness, flavours) of these hams, processors now intend to increase the hams’ ripening duration, from minimum of 20 months required in PDO

Product name	Type of the product	Status of the product	Label/logo
Jambon Noir de Bigorre	Dry-cured ham	AOC (French label) and PDO "Noir de Bigorre"	*AOC, PDO and Noir de Bigorre*
Porc Noir de Bigorre	Carcass and meat	AOC (French label) and PDO "Noir de Bigorre"	*AOC, PDO and Noir de Bigorre*
Pâté	Pâté	No specific status; "from Noir de Bigorre pork"	*Noir de Bigorre*
Boudin noir	Black blood pudding	No specific status; "from Noir de Bigorre pork"	*Noir de Bigorre*
Rillettes	Rillettes	No specific status; "from Noir de Bigorre pork"	*Noir de Bigorre*
Andouille	Andouille	No specific status; "from Noir de Bigorre pork"	*Noir de Bigorre*

Table 8.
Main products from Gascon pig breed.

Figure 5.
From left to right: Logo of noir de Bigorre (for all products produced by the chain), AOC (for AOC/PDO carcass and fresh meat and AOC/PDO dry-cured ham; French label, mandatory before PDO registration) and AOP (for AOC/PDO carcass and fresh meat and AOC/PDO dry-cured ham; French translation for PDO).

specifications to 24 months. The production of longer ripening hams is also considered with products aged 36 months to allow further development of specific and very high eating properties and thereby propose a wider range of high-quality "gourmet" products to consumers (**Figure 5**).

Acknowledgements

The research was conducted within the project TREASURE, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 634476. The content of this paper reflects only the author's view, and the European Union Agency is not responsible for any use that may be made of the information it contains.

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References

[1] Bulletin officiel du Ministère de l'agriculture, de l'agroalimentaire et de la forêt, No. 2015-53; 2015

[2] Lenoir H. Races locales: La progression des effectifs est conditionnée par la valorisation. Techni Porc. 2014;**20**:32-35

[3] Viso M. Élevage porcin et races rustiques dans le Piémont Pyrénéen [thesis]. Maisons-Alfort, France: Ecole Nationale Vétérinaire d'Alfort; 1977

[4] Daridan D, Simon MN. Etude sur l'intérêt économique de la race porcine Gasconne pour la production d'une charcuterie sèche de qualité en Midi Pyrénées. In: IFIP Final Report. Convention No. 9507391. 1999

[5] Marsac H, Luquet M, Labroue F. Premier bilan annuel des performances de reproduction des 5 races locales porcines françaises. Techni Porc. 1999;**22**:31-40

[6] Labroue F, Guillouet P, Marsac H, Boisseau C, Luquet M, Arrayet J, et al. Etude des performances de reproduction de 5 races locales porcines françaises. Journées de la Recherche Porcine. 2000;**32**:413-418

[7] Lenoir H, Luquet M, Mercat M-J. Effectifs et performances de reproduction des 5 races locales porcines françaises. Techni Porc. 2002;**25**:25-30

[8] Lenoir H, Mercat M-J. Bilan des effectifs, des performances de reproduction et de la variabilité génétique des 6 races locales. Techni Porc. 2008;**31**:15-22

[9] Leenhouwers JI, Merks JWM. Suitability of traditional and conventional pig breeds in organic and low-input production systems in Europe: Survey results and a review of literature. Animal Genetic Resources/ Resources génétiques animales/Recursos genéticos animales. 2013;**53**:169-184. DOI: 10.1017/S2078633612000446

[10] Mercat MJ. TREASURE Survey WP 1.3, Personal Communication; 2017

[11] Mercat MJ, Lenoir H. Average Data from LIGERAL Database between 2012 and 2016; 2017

[12] Gueblez R, Labroue F, Mercat M-J. Performances de croissance, carcasse et qualité de viande de 4 races locales. Techni Porc. 2002;**25**:5-15

[13] Legault C, Audiot A, Daridan D, Gruand J, Lagant H, Luquet M, et al. Recherche de rèfèrences sur les possibilitès de valoriser les porcs Gascon et Limousin par des produits de qualité 1. Engraissement, carcasses, coûts de production. Journées de la Recherche Porcine. 1996;**28**:115-122

[14] Simon M-N, Jacquin M-P, Liardou M-H, Daridan D, Legault C. Recherche de références sur les possibilités de valoriser les porcs Gascons et Limousins par des produits de qualité. Journées de la Recherche Porcine. 1997;**29**:397-404

[15] Sans P, Gandemer G, Sanudo C, Metro B, Sierra I, Darre R. Performances zootechniques et qualité de la carcasse, de la viande et du tissu adipeux chez le porc Gascon élevé à la ferme. Journées de la Recherche Porcine. 1996;**28**: 131-136

[16] Lebret B, Lenoir H, Daré S, Fonseca A, Mercat MJ. Quality of products from Gascon pigs in extensive system of the noir de Bigorre pork chain: Influence of season and feeding resources. Journées de la Recherche Porcine. 2019. In press

[17] Lebret B, Lenoir H, Fonseca A, Faure J, Mercat MJ. Quality of PDO noir de Bigorre pork products according to pig feeding and season in extensive

system. In: Proceedings of the 68 Annual Meeting of the European Federation of Animal Science (EAAP); 28 August-1 September 2017; Tallinn, Estonia. Wageningen, Nederlands: Wageningen Academic Publishers; 2017. p. 109

[18] Sans P, Andrade MJ, Ventanas S, Ruiz J. Quality characteristics of fresh meat from pigs of the Gascon breed. Food Science and Technology International. 2004;**10**:29-34. DOI: 10.1177/1082013204041347

[19] Lebret B. Effects of feeding and rearing systems on growth, carcass composition and meat quality in pigs. Animal. 2008;**2**:1548-1558

[20] Lebret B, Mourot J. Characteristics and quality of pig adipose tissues. Influence of rearing factors. INRA Productions Animales. 1998;**11**:131-143

[21] Bonneau M, Lebret B. Production systems and influence on eating quality of pork. Meat Science. 2010;**84**(2): 293-300