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Sarda Pig

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Abstract

Sarda pig breed (a.k.a. Suino Sardo) is a local breed from Sardinia Island (Italy) with its ancestors dating back to the Nuragic period. It is the most recent breed interested by a conservation programme among the six Italian autochthonous pig breeds investigated by the H2020 project TREASURE and could be considered untapped in terms of information on its performances and products. Thirteen farms were registered at the last census (2015) including sixty-one breeding sows and twenty boars. It is a small size breed with black, grey, tawny or spotted coat colour. On average, age at parturition is 15.7 months, with 1.6 litters per year and 7.8 piglets per parity. Average piglet mortality is rather high in the considered studies (16.1%). The average daily gain for Sarda pig within the considered studies was 423 g/day. On average, daily feed intake in the overall fattening stage was 2.3 kg/day. Sarda pigs were slaughtered at approximately 686 days of age, at an average live weight of 193 kg. Sporadic information is available for meat quality traits. Although studies on Sarda pig are scarce, the current review gives the first insight into this local pig breed.

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

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

The Sarda or Suino Sardo is a breed of domestic pig from the Mediterranean island of Sardinia (Italy). Evidences of the present pig population in Sardinia date back to 2nd millennium BC [1]. Nuragic sites have returned large quantities of bones and some bronze representations of domestic pigs. Historical and bibliographic research and field surveys have shown that pig breeding in Sardinia has ancient origins documented by numerous prehistoric and historical traces [2]. During the Roman domination, due to the tributes that Sardinia was forced to pour and to the presence of large areas of oaks in the island, there was an increase in pig breeding. Medieval period reported various written records on pig breeding. For instance, the “Codice Rurale di Mariano IV” reported the fees for who leave the pigs on the vineyards as well as the rule that forbid to introduce pigs in the pastures during the fall and winter periods. Sarda pigs and wild boars have been sympatric for centuries in the region, and it has recently been showed that Sarda pig breed belongs to *Sus scrofa meridionalis* subspecies [3, 4]. Since 2006, the breed conservation program based on several small breeding nuclei is active. Presently, there are 13 registered farms of Sarda pigs with about 61 breeding sows and 20 boars in the latest available status [5]. Census of Sarda pig breed is presented in **Figure 1**.

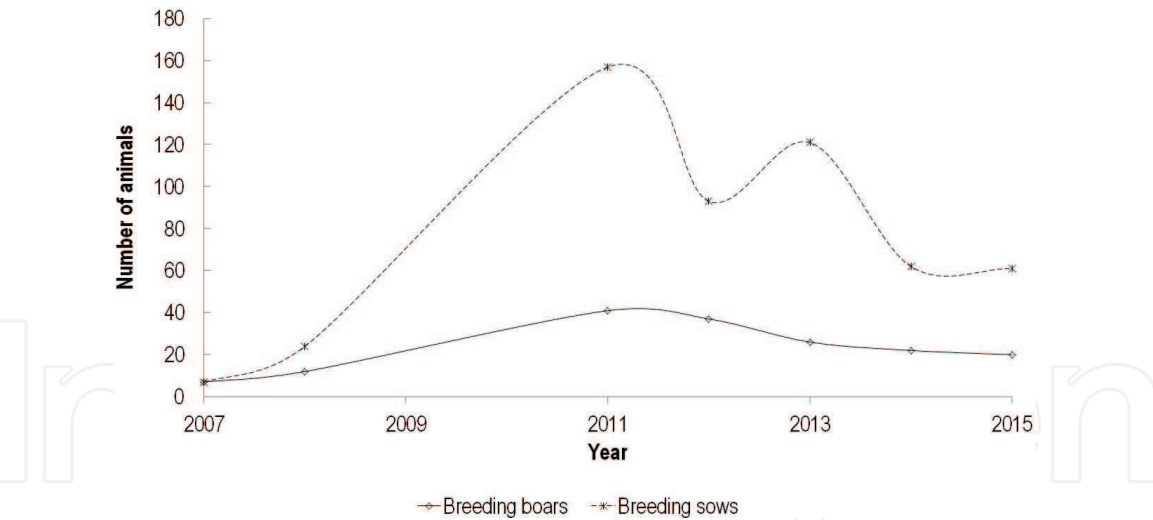


Figure 1.
Census of Sarda pig breed, presenting number of sows and boars per year, starting with the year of heard book establishment.

2. Exterior phenotypic characteristics

The Sarda is a small size breed with black, grey, tawny or spotted coat colour (**Figures 2 and 3**). The bristles are numerous, long and rough, and on the dorsal line, they make up a mane. A lumbar tuft is possible. The head is of medium development, cone-shaped with a straight profile, small ears kept high up or leaning on the side. Wattles are sometimes present. Long tail with bristles sometimes forms a characteristic “horse” tail. Even if the breed presents large phenotypic variability, some morphological traits are considered indicators of crossbreeding and are thus cause of exclusion from the registry: absence of bristles, totally depigmented skin, straight ears, concave profile, striated cloak or agouti, presence of white band, even partial, on the chest. Sows of Sarda breed have on average 12.7 teats.



Figure 2.
Sarda sow with piglets (photo credit LAORE Sardegna).

3. Geographical location and production system

Sarda pigs are raised mainly in the provinces of Ogliastra and Nuoro but are also present in those of Medio Campidano and Sassari and in the Sarrabus-Gerrei subarea. These are the classical areas of pig breeding in Sardinia as already reported by Cetti [6]. The local pig is bred in the wild or semi-wild without any type of



Figure 3.
Sarda boar (photo credit S. Porcu).

control or fences with frequent exchanges between wild boars and domestic pigs. This is one of the reasons of the difficult eradication of the African swine fever (ASF) disease as reported by Jurado et al. [7]. Animals often graze on public lands, with minimal recourse to shelters consisting of hollow trunks or shelters (in wood and/or stone). Animals are fed mainly on the natural resources of the oak and chestnut woods where they graze freely; the integration is minimal and commonly consists of cereals (flour or grain) or legumes, offered during periods of food shortage. With this production system, the animals remain in the herd during more than 1 year and they are slaughtered quite old. It is thus common to simultaneously have young pigs, middle aged pigs, and old animals (up to 3 years of age and more than 100 kg). Furthermore, seasonality of the events (births and slaughters) is a common management practice in Sarda breed. Animals are accustomed by the farmers to respond to their voice calls at pre-established points, where they receive the daily amount of food, directly offered on the ground [8].

4. Organisations for breeding, monitoring and conservation

The Italian Pig Breeders Association (ANAS) is the organisation responsible for monitoring the breed, and the activity is aimed at the conservation of the breed with particular regard to the maintenance of genetic variability. The regional body of Sardegna contributes to the initiatives aimed to preserve and valorize the breed posing special attention to ASF disease. A Consortium (Consorzio Produttori Suini di Razza Sarda) has also been established in 2010 (**Table 1**). Sarda breed has been officially recognized by the Italian Ministry of Agriculture in 2006.

Name of organisation	Address	Web or e-mail address
Associazione Nazionale Allevatori Suini (ANAS)	Via Lazzaro Spallanzani 4, 00161 Rome, Italy	www.anas.it
Consorzio Produttori Suino di Razza Sarda	Località Genn'Antine, 08049 Villagrande Strisaili (NU), Italy	c.s.r.s@tiscali.it

Table 1.
Contact details of breeding organisations for Sarda pig breed.

5. Productive performance

5.1 Reproductive traits

Basic data obtained on reproductive traits in this review are presented in **Table 2**. According to data registered in ANAS database [5], the age of sows at first parturition is 25.3 months, whereas the age at culling is 60 months. Sows of Sarda pig breed have 1.2–2.0 litters per year [9, 10] with 5.6–9.4 piglets [5, 9, 11] of only 0.3 kg live body weight [10]. Stillborn percentage of piglets and piglet mortality rate until weaning reported within collected studies are quite high (12.1–16.1 and 11.1–20.0%, respectively; [5, 9, 11]). Duration of lactation is prolonged in comparison to modern intensive systems (to 37 days; [11]), which leads to a longer farrowing interval (180–304 days; [9, 10]) and higher piglet weaning weight (7.7; [11]). Extended lactation in such production system serves also as protection against predators as well as to increase the learning process period in such unfavourable areas.

5.2 Growth performance

Basic data on growth performance obtained in this review are presented in **Tables 3 and 4**. Due to big differences between studies with regard to the live weight range covered, we defined the stages for growth performance as growing stage (from weaning to approximately 30 kg live body weight) and 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 fattening stage (defined as overall). It should also be noted that the major part of the collected studies simulated practical conditions of the production systems used and that only a smaller part of the studies actually aimed at evaluating the breed potential for growth. In the considered studies, data on the average daily gain in lactation were not found, whereas reported average daily gains in growing, early, middle and late fattening stage were on average 342, 352, 494, and 525 g/day ([11, 15, 16], respectively), but it has to be pointed out that the obtained results within each stage were very different and thus the averages reported have to be considered cautiously. The average daily gain in the period from birth to slaughter reported for Sarda pig within the considered studies averages 423 g/day [10, 11], which is lower compared to modern breeds of pigs. 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 Sarda pigs in *ad libitum* conditions of feeding (≈ 910 g/day in late fattening stage and 657 g/day in overall fattening stage).

In considered studies, the information on feed intake and feed nutritional value were limited, which also limits the evaluation of growth potential. Average daily feed intake increased from approximately 1.1 kg/day [11] in growing stage to 3.6 kg/day [11] in late fattening stage (declared as *ad libitum* feeding), whereas average daily feed intake in the overall fattening stage was 1.7–2.7 kg/day [11]. In the context of the evaluation of feed intake, it is also of interest to observe the extreme values, because it can be assumed that the maximum figures exhibit the maximal feed intake of Sarda pigs in *ad libitum* conditions of feeding. Porcu [17] reports that Sarda pigs consumed 6.3 kg/day in late fattening stage when feed was offered on *ad libitum* basis (estimated between 98 and 294 kg body weight), whereas in overall fattening stage, maximal feed intake reported was 2.7 kg/day (estimated until 100 kg body weight; [11]).

Reference	Sow age at first parturition (mth)	Litters per sow per year	No. of piglets alive per litter	Piglet live weight (kg)	Stillborn per litter (%)	Mortality at weaning (%)	Piglet weaning weight (kg)	Duration of lactation (d)	Farrowing interval (d)	Sow age at culling (mth)
[5]	25.3		5.6	-	16.1	16.5	-	-	-	60
[9]	-	1.2	8.3	-	-	11.8	-	-	304	-
[12]	-	-	-	-	-	-	-	-	-	-
[11]	-	-	9.4	-	12.1	20.0	7.7	37	-	-
[13]	12.3	-	-	-	-	-	-	-	-	-
[14]	-	-	-	-	-	-	-	-	-	-
[10]	9.5	2.0	-	0.3	-	-	-	-	180	-

No. = number, mth = month and d = days.

Table 2.
Summary of collected literature data on reproduction traits in Sarda pig breed.

Reference	Feeding	No. of animals	ADG growing ^a	ADG fattening ^b			
				Early	Middle	Late	Overall
[11]	Ad Lib	24	368	368	-	-	368
	Ad Lib	24	-	-	414	-	392
	Ad Lib	24	416	-	-	-	-
	Ad Lib	24	-	-	-	-	522
	Ad Lib	24	-	-	-	341	422
	Ad Lib	24	153	-	-	-	-
	Ad Lib	24	-	312	-	-	312
	Ad Lib	24	-	-	466	-	326
	Ad Lib	24	377	377	-	-	377
	Ad Lib	24	-	-	603	454	450
	Ad Lib	-	397	-	-	-	-
	Ad Lib	-	-	-	-	-	657
	Ad Lib	-	-	-	-	622	529
[10]	-	-	-	-	-	-	300
[15–17]	Ad Lib	4	-	-	-	910	-
	Rest	4	-	-	-	351	-
	Rest	4	-	-	-	469	-

No. = number, ADG = average daily gain in g, Ad Lib = ad libitum feeding regime, and Rest = restrictive feeding regime.
^aADG in growing period estimated from weaning to approximately 30 kg live body weight.
^bADG 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 3.
Summary of collected literature data on the average daily gain (in g) in Sarda 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 5**. In considered studies, pigs of Sarda breed were slaughtered at approximately 686 days of age [15, 16, 18], at an average 193 kg live weight (106–294 kg; [15, 16, 18]) and reached dressing yield around 77% [10, 18]. The back fat thickness value measured at the withers varied from 30 to 85 mm [15, 16, 18], at the position of the last rib 28 mm [18] and at the level of last rib 41 mm [18]. No data providing measurements of muscularity were found in considered studies.

5.4 Meat quality

Basic data obtained in this review with some of the most commonly encountered meat and fat quality traits measured in *longissimus* muscle that could be found are presented in **Table 6**. The pH of meat for Sarda pig breed has been measured only

Reference	Feeding	CP content of feed (%)	No. of animals	ADFI growing ^a	ADFI fattening ^b			
					Early	Middle	Late	Overall
[11]	Ad Lib	17.0	24	1.6	1.6	-	-	-
	Ad Lib	12.0	24	-	-	2.9	2.9	2.3
	Ad Lib	18.6	24	1.0	-	-	-	-
	Ad Lib	16.8	24	-	-	-	-	2.7
	Ad Lib	17.3	24	-	-	-	2.8	2.4
	Ad Lib	19.0	24	0.6	-	-	-	-
	Ad Lib	16.0	24	-	1.5	-	-	-
	Ad Lib	15.0	24	-	-	2.8	-	1.7
	Ad Lib	13.5	24	1.4	1.4	-	-	-
	Ad Lib	12.0	24	-	-	2.5	2.8	2.1
	Ad Lib	18.6	-	0.9	-	-	-	-
	Ad Lib	16.8	-	-	-	-	-	2.4
	Ad Lib	17.3	-	-	-	-	3.4	2.5
[15, 17]	Ad Lib	-	4	-	-	-	6.3	-

No. = number, ADFI = average daily feed intake in kg/day, Ad Lib = ad libitum feeding regime, ME = metabolisable energy, and CP = crude protein.

^aADFI in growing period estimated from weaning to approximately 30 kg live body weight.

^bADFI 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 daily feed intake for the whole studied period (in that case defined as overall).

Table 4.
Summary of collected literature data on the average daily feed intake (in kg/day) in Sarda pig breed.

Reference	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Back fat thickness (mm)		
						S ^a	At withers	At last rib
[10]	-	-	-	75	77.0	-	-	-
[15-17]	4	671	294	-	-	-	85	-
	4	671	171	-	-	-	30	-
	4	671	202	-	-	-	40	-
[18]	15	730	106	82	77.2	41	32	28

No. = number, BW = body weight and CW = carcass weight.

^aS back fat thickness measured according to ZP method (above Gluteus medius muscle (mm)).

Table 5.
Summary of collected literature data on body composition and carcass traits in Sarda pig breed.

by Porcu [17]. PH values in *longissimus* muscle at 45 min and 24 h *post mortem* was 6.07 and 5.98, respectively. Objective colour measured in CIE L, a and b colour space was 48, 14.4, and 8.5 for L, a* and b*, respectively [15–18]. No data providing measurements of intramuscular fat content and fatty acid composition of intramuscular or back fat were found in considered studies.

Reference	No. of animals	pH 45	pH 24	CIE ^a		
				L*	a*	b*
[15–17]	4	-	-	48	16.0	9.9
	4	-	-	50	15.4	10.0
	4	-	-	52	14.9	10.1
[18]	15	6.07	5.98	40	11.2	4.0

No. = number, pH 45 = pH measured approximately 45 minutes post-mortem, and pH 24 = pH measured approximately 24 hours post-mortem.
^aCIE = objective colour defined by the Commission Internationale de l'Eclairage, L* greater value indicates a lighter colour, a* greater value indicates a redder colour and b* greater value indicates a more yellow colour.

Table 6.
Summary of collected literature data on meat quality in Sarda pig breed.

6. Use of breed and main products

More than 50% of Sarda pig farmers raise the animals for the entire cycle producing traditional cured meats used for family needs. The part exceeding self-consumption is sold on the local market, especially during the summer period with a high number of tourists present in the island. The main products are represented by sausages, bacon (rolled up or not), “guanciaie” and “coppa” as well as cured ham and shoulder. Equally important is the consumption of piglets, slaughtered at the age of 35–45 days, which is one of the traditional dishes of typical Sardinian cuisine. Besides these classical products, it is possible to recognize three different local productions never recorded in the atlas of typical products: traditional ham, shoulder ham with bacon, and “sartizza a lorika”. This last product is a very long sausage that can even exceed 3 metres in length with a spiral shape [19] and recalls the sausages known as the “longaones” [20] described in the Roman period. Currently, Sarda pig breed and its products face two major problems: the presence of ASF, difficult to control and eradicate due to the type of breeding and the presence of many unrecognized farms (for which it is difficult to establish the real consistency of the animals belonging to the native breed; [21]).

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