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# Cinta Senese Pig

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## Abstract

Cinta Senese is an Italian autochthonous pig breed, one of the local pig breeds investigated in the project TREASURE. The present chapter aims to present history and status of Cinta Senese pig breed, its phenotypic characteristics, geographical location, production system and the quality of its main products. Reproductive performance was estimated by several data: sow age at first parturition, litters/sow/year, piglets alive/litter, weaning weight, stillborn/litter, death rate percentage at weaning, duration of lactation, length of farrowing and sow age at culling. Growth performance was estimated by means of average daily gain in lactation and from birth to slaughter, growing at early, middle, late and overall fattening stage and average daily feed intake in late and overall fattening stage. Carcass traits were evaluated by means of age and weight at slaughtering, hot carcass weight, carcass yield, loin eye area and back fat thickness at the first thoracic vertebra, last rib and above *gluteus medius* muscle. Meat quality traits of the *longissimus* muscle were evaluated by means of the following: pH at 45 minutes and 24 hours after slaughtering, instrumental measurements of colour (CIE L\*, a\*, b\*) and intramuscular fat content. Fatty acid composition was evaluated in back fat tissue.

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

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

The Cinta Senese breed has ancient origins, as evidenced by its presence in the fresco of the “Buon Governo” of Ambrogio Lorenzetti which is in the Sala del Consiglio dei Nove of the Palazzo Pubblico of Siena [1]. It has spread for its robustness, rusticity and easy adaptability to breeding outdoor. This breed is well adapted at Tuscany land because of the type of available feeding resources from these territorial peculiarities that also derive the taste of the meat protected by PDO label since 2012 [2]. In the 1950s, most peasant families raised this breed. The introduction of improved breeds has reduced the Cinta Senese breeding to bring this breed, at the beginning of the eighties, to the brink of extinction. Due to the intervention of local breeders and Protection Consortium and the active support of the public institutions as well as a detailed research activity carried out by the University of Florence, to date, 140 farms and about 5000 animals can be recognised (**Figure 1**) [3, 4]. Almost all Cinta Senese breeders are part of the Consortium of Protection of the Cinta Senese obtaining the protected denomination of origin of fresh meat, exclusively for pigs born, reared and slaughtered in Tuscany, and deriving from the



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

mating of subjects recorded in the Register of the Cinta Senese genetic type. According to the PDO rule, after the fourth month of age, during which the piglets can receive daily food supplementation, the animals must be reared in extensive conditions [2]. The permitted daily feed supplement cannot exceed 2% of live weight; additionally, at least 60% of the feed constituents must come from the geographical area of production.

## 2. Exterior phenotypic characteristics

The Cinta Senese is a medium-sized pig, with a light but solid skeleton (Figures 2 and 3). The weight is 300 and about 250 kg for boars and sows, respectively. The skin and bristles are black, except for a white band that surrounds the trunk at shoulder level, including the forelimbs. The head is of medium size with ears directed forward and down. The limbs are thin but solid. In the female the breasts must be not less than 10, regularly spaced, with normal nipples (Table 1).

Measurement (average)	Adult male	Adult female
Body weight (kg)	200	170–180
Body length <sup>1</sup> (cm)	107	104
Ear length	Medium	Medium
Chest girth (cm)	132	126
Height at withers (cm)	82–90	82–90
Number of teats (average)	12	12

<sup>1</sup>Measured from the tip of the nose to the starting point of the tail.

**Table 1.** Summary of morphology information on Cinta Senese pig breed.



**Figure 2.**  
*Cinta Senese sow with piglets.*



**Figure 3.**  
*Cinta Senese boar.*

### 3. Geographical location and production system

The farms of Cinta Senese pigs are located throughout the Tuscany region even though most of them are in the province of Siena. Pasture on wood is carried out in more than half of the farms. The sows are mainly raised outdoors, but, frequently, in case of part, single boxes are used. The fattening is always done outdoors, with various degrees of extensification. The forest, when present, is used for grazing throughout the year from farmers. It is noted that neither the farming area nor that used for grazing are related to the number of animals bred. There are indeed farms of large dimensions with a reduced number of animals, as well as farms with many animals but with little available area, both for grazing and for the crops, to be dedicated for breeding. Finally, farms with many animals, even when they have a large surface available, dedicate a very small part of the land to pigs [5]

### 4. Organisations for breeding, monitoring and conservation

The Cinta Senese conservation programme involves regional and national associations (ARA, ANAS) as well as research institutes (University of Florence) (Table 2). The conservation programme includes:

Name of organisation	Address	E-mail address
Consorzio di tutela della Cinta Senese	Strada di Cerchiaia, 41/4-53100 Siena, Italy	cinta-senese@libero.it
Associazione Nazionale Allevatori Suini (ANAS)	Via Lazzaro Spallanzani 4, 00161 Rome, Italy	www.anas.it

**Table 2.**

Contact details of breeding organisation for Cinta Senese pig breed.

- The morphological evaluation of all young animals.
- Registration at Anagraphic Register of eligible boars.
- Registration of the main productive and reproductive traits.
- Choice of male young boars.
- Planning of mating and assistance to farmers in choosing the boars.
- Monitoring the level of consanguinity in the population.

The conservation programme foresees financial support for Cinta Senese breeders within a larger project aimed at the maintenance of indigenous breeds threatened by the risk of abandonment.

## 5. Productive performance

### 5.1 Reproductive traits

Basic data obtained on reproductive traits in this review are presented in **Table 3**. According to herdbook data recorded by ANAS, the age of sows at first parturition is approximately 20 months, whereas age of culling is 54.3 months on average. Sows of Cinta Senese pig breed have 1.3–1.8 litters per year with 6.3–8.2 piglets per litter of approximately 1.2 kg of live body weight. Stillborn percentage of piglets varies from 2.1 to 9.6%, whereas piglet mortality rate until weaning ranged from 4.7 up to 20.4% in the considered studies. Duration of lactation is prolonged in comparison to modern intensive systems (up to 60 days), which leads to a longer farrowing interval (from 203 to 281 days) and also higher piglet weaning weight (8.5–13.0 kg).

### 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 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) or even from birth to slaughter (defined as birth-slaughter, which is often calculated from the data given on live

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)
[3]	13.0	1.7	–	0.8	–	–	–	–	210	72.0
[4]	20.9	–	7.2	–	2.1	7.1	–	–	–	54.3
[6]	–	1.3	8.2	–	–	6.4	–	–	281	–
[7]	–	–	–	–	–	–	–	–	–	–
[8]	–	–	6.3	1.1	8.2	4.7	–	–	–	–
[9]	–	–	–	1.3	–	–	11.5	60	–	–
[10]	–	–	7.9	1.2	7.6	20.4	8.5	44	–	–
[11]	–	–	–	–	–	–	–	–	–	–
[12]	–	–	–	–	–	–	–	–	–	–
[13]	–	1.8	7.9	1.2	–	–	8.5	44	203	–
[14]	–	–	–	–	–	–	–	–	–	–
[15]	–	–	7.3	1.4	9.6	6.9	9.4	38	–	–
[16]	–	–	–	1.3	–	–	13.0	60	–	–
[17]	–	–	–	1.3	–	–	–	–	–	–
[18]	–	1.6	6.8	–	–	9.7	–	58	230	–
[19]	–	1.6	6.8	–	–	9.7	–	–	–	–

No., number; mth, month; d, days.

**Table 3.**  
Summary of collected literature data on reproduction traits in Cinta Senese pig breed.



Reference	Feeding	No. of animals	ADG lactation <sup>1</sup>	ADG growing <sup>2</sup>	ADG fattening <sup>3</sup>				ADG birth-slaughter
					Early	Middle	Late	Overall	
[3]	-	-	-	-	-	-	-	500	-
[9]	-	3028	158	-	-	-	-	185	-
[10]	-	7	133	174	-	-	-	-	-
	-	8	196	396	-	-	-	-	-
[13]	-	922	133	-	-	-	-	-	-
	-	-	196	-	-	-	-	-	-
[16]	-	-	196	267	211	-	-	-	-
[17]	Semi	29	-	-	-	-	-	430	-
	Rest	17	-	-	-	-	-	248	-
[17, 20, 21]	Semi	29	-	-	-	-	-	433	-
[19]	-	-	-	-	-	-	-	-	276
[22]	-	277	235	-	-	-	-	-	-
[23]	Rest	16	-	473	-	-	310	519	-
[24]	-	29	-	-	-	-	-	531	-
[25]	Semi	29	-	-	-	-	-	438	-
	Rest	16	-	-	-	-	-	250	-
[26, 27]	Semi	27	-	-	432	334	334	372	-
[28]	Semi	17	-	-	-	-	-	387	-
[29]	Semi	60	-	-	-	-	-	417	-
[30]	Semi	24	-	-	-	-	-	419	-
[31, 32]	Rest	8	-	-	-	-	323	-	-
	Semi	8	-	-	-	-	297	-	-
[33]	Semi	33	-	-	-	-	346	-	-
[34]	-	24	-	-	-	-	-	370	-
[35]	Ad Lib	12	-	-	674	-	-	674	-

No.—number; ADG, average daily gain in g; Ad Lib—ad libitum feeding regime; Semi—semi ad libitum feeding regime; and Rest—restrictive feeding regime.

<sup>1</sup>ADG in period of lactation regardless of how long it was.

<sup>2</sup>ADG in growing period estimated from weaning to approximately 30 kg live body weight.

<sup>3</sup>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 Cinta Senese pig breed.

weight and age of pigs). 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, daily gain in lactation period varied from 133 to 235 g/day. Growing and fattening stages are characterised by a slow growth rate (approximately 370 g/day in growing and 412 g/day in overall fattening stage) but also high variability between studies (from 147 to 473 g/day growing and from 185 to 674 g/day in fattening stage). Slower growth rate can be contributed to the fact that

Reference	Feeding	ME content of feed (MJ/kg)	CP content of feed (%)	No. of animals	ADFI fattening <sup>1</sup>	
					late	overall
[24]	–	–	17	29	–	2.4
[33]	Semi	10.7	18	33	2.7	–
[34]	–	–	–	24	–	2.2

No.—number; ADFI—average daily feed intake in kg/day; Semi—semi ad libitum feeding regime; ME—metabolisable energy; and CP—crude protein.

<sup>1</sup>ADFI in a period of fattening is reported late fattening stage estimated above 100 kg live body weight and for the overall daily feed intake in the whole fattening period (estimated from 30 kg body weight onwards).

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

according to PDO rules, Cinta Senese pigs should be reared in extensive conditions. However, 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 Cinta Senese pigs in *ad libitum* conditions of feeding ( $\approx 674$  g/day in early fattening stage).

In considered studies, the information on feed intake and feed nutritional value were scarce, which limits the evaluation of growth potential. In accordance to PDO rule that feed distribution should not exceed 2% of body weight, average daily feed intake reported in the considered studies was 2.7 kg/day in late fattening stage and 2.2–2.4 kg/day in the overall fattening stage.

### 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 Cinta Senese breed were slaughtered at approximately 381 days of age and from 125 to 175 kg of live weight. In agreement with high slaughter weight, dressing yield was around 81%; back fat thickness span from 47 to 65 mm measured on the withers, from 32 to 58 mm at last rib level and 35–67 mm at *gluteus medius* muscle level. Muscularity measured as loin eye area was 28 cm<sup>2</sup> in the only available

Reference	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Back fat thickness (mm)			Loin eye area (cm <sup>2</sup> )
						S <sup>1</sup>	At withers	At last rib	
[3]	–	–	175	140	80.0	–	–	–	–
[17]	29	312	135	110	81.2	–	–	–	–
	17	509	127	104	81.6	–	–	–	–
[17, 20, 21]	29	312	136	110	81.2	49	–	–	–
[23]	16	330	147	–	–	35	47	32	–
[25]	29	312	136	110	81.2	46	58	40	–
	16	510	128	104	81.5	49	65	37	–
[26, 27]	27	336	125	98	78.6	35	–	–	–



Reference	No. of animals	Final age (d)	Final BW (kg)	Hot CW (kg)	Dressing yield (%)	Back fat thickness (mm)			Loin eye area (cm <sup>2</sup> )
						S <sup>1</sup>	At withers	At last rib	
[28]	17	430	155	–	–	43	–	41	–
[29]	60	419	147	121	82.2	46	52	41	28
[30]	24	340	136	110	80.6	–	–	49	–
[31, 32]	8	–	142	121	84.7	44	50	46	–
	8	–	143	123	86.5	44	52	49	–
[33]	33	378	130	–	–	41	–	–	–
[36]	50	–	141	110	78.0	67	78	58	–
[37]	14	–	145	–	–	–	–	30	–

No.—number; BW—body weight; and CW—carcass weight.

<sup>1</sup>S back fat thickness measured according to ZP method (above the gluteus medius muscle (mm)).

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

Reference	No. of animals	pH 45	pH 24	CIE <sup>1</sup>			IMF content (%)	Fatty acid composition <sup>2</sup> (%)			
				L*	a*	b*		SFA	MUFA	PUFA	n-6 / n-3
[13]	–	–	–	48	12.3	4.2	4.0	–	–	–	–
	–	–	–	46	11.8	4.5	3.3	–	–	–	–
[17]	29	6.22	5.78	50	–	–	3.2	–	–	–	–
	17	6.24	5.83	46	–	–	4.2	–	–	–	–
[17, 20, 21]	29	6.22	5.78	50	11.4	4.6	3.2	36.2	53.4	10.4	25.7
[26, 27]	27	6.50	5.63	48	12.7	4.0	2.5	–	–	–	–
[28]	17	6.51	5.68	46	12.3	3.0	6.0	–	–	–	–
[29]	60	6.40	5.83	46	11.0	2.9	4.7	–	–	–	–
[30]	24	6.51	5.78	47	11.2	3.3	4.1	39.0	52.8	8.2	36.4
[31, 32]	8	6.33	5.55	–	–	–	–	37.6	50.6	11.8	14.2
	8	6.40	5.50	49	13.9	4.5	5.9	36.7	51.6	11.7	20.0
[33]	33	6.42	5.55	49	11.4	4.0	3.3	38.9	49.9	11.2	24.4
[37]	14	–	–	47	13.7	4.2	3.2	35.4	47.6	17.0	12.8
[38]	–	–	–	47	12.4	3.8	4.0	–	–	–	–
[39]	17	6.51	5.69	45	12.2	3.0	5.7	–	–	–	–

No.—number; pH 45—pH measured approximately 45 minutes post-mortem; pH 24—pH measured approximately 24 hours post-mortem; IMF—intramuscular fat; SFA—saturated fatty acids; MUFA—monounsaturated fatty acids; PUFA—polyunsaturated fatty acids.

<sup>1</sup>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.

<sup>2</sup>For fatty acid composition, only pigs on control diet were considered. Control diets differed among studies, to see diet composition address to the corresponding source.

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

study, whereas data providing other measurements of muscularity (i.e. lean meat content or muscle thickness measured at the cranial edge of the *gluteus medius* muscle) were not available in the considered studies.

#### 5.4 Meat and fat quality

Basic data obtained in this review with some of the most commonly encountered meat quality traits measured in the *longissimus* muscle that could be found and fatty acid composition of back fat tissue are presented in **Table 7**. In the studies reporting meat quality of Cinta Senese pigs, pH measured in the *longissimus* muscle at 45 minutes and 24 hours post-mortem was approximately 6.4 and 5.7, respectively. The intramuscular fat content was highly variable in considered studies and ranged from 2.5 to 6.0%. Colour measured in CIE/Lab colour space spans from 45 to 50, 11.0 to 13.9 and 2.9 to 4.6 for L, a\* and b\*, respectively. Altogether six studies were found reporting fatty acid composition of back fat tissue; however, due to big differences between studies in feeding regime, feed composition, final body weight and fatness, which are all important factors influencing the fatty acid composition of meat, this result should be interpreted with precaution. Saturated fatty acid content ranges from 35.4 to 39.0%, MUFA content from 47.6 to 53.4% and PUFA content from 8.2 to 17.0%, with very high n-6 to n-3 ratio (12.8–36.4).

#### 6. Use of breed and main products

The quality of the raw material of the Cinta Senese represents a strong point of the system. The sensory characteristics of meat are mainly influenced by the acidic composition of the adipose tissue which is affected, as well as the genetic component, also by the diet. Extensive breeding, if practised with rational exploitation of forest resources (acorn and chestnut), can lead to the development of favourable aromas and, therefore, to products with excellent sensory properties. The main cured meats produced with the Cinta Senese breed are dry-cured ham, Tuscan salami, Pancetta, Lardo and Capocollo. These products have reached a high level of quality without, however, reaching the standardisation of flavours. Although the cured meat market is expanding, the Consortium focused on the PDO label of fresh meat, obtaining it. The recognition of protected designation of origin is reserved exclusively for the meat of pigs born, reared and slaughtered in Tuscany, which meet the requirements of the specification, drawn up by EU Reg. 510/2006. To certify the meat, the pigs must derive from the pairing of pigs registered in Anagraphic Register of the Cinta Senese genetic type.

Animals cannot be slaughtered before the twelfth month of life. After slaughtering the half-carcass can be cut to produce cured meats. The seal consortium represents the identifying mark of the processed products.

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