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MAIN LECTURE

Italian autochthonous pigs: progress report and research perspectives

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ABSTRACT: Characteristics and research perspectives of autochthonous Italian pig are summarised and discussed. Nowadays only six breeds are still farmed (*Mora Romagnola*, *Cinta Senese*, *Casertana*, *Calabrese*, *Nero Siciliano* and *Sarda*), on twenty-one local pig genotypes existing in Italy at beginning of the last century. Recently all the breeds are recorded on the National Pedigree Register. For the genetic conservation of these populations, an adequate management of mating appears fundamental to limit the inbreeding and to increase the genetic variability, as nowadays it is carried out in *Cinta Senese* that offers the deepest pedigree. For *Nero Siciliano* and *Sarda*, individuation of morphological standard and recovery of appropriate genotypes appear also urgent. From the recent literature it is evident that the local breeds are worse than the improved ones in reproductive performance and productive traits as growth rate, feed conversion and carcass composition but they show interesting quality of meat and fat. Among the six breeds *Cinta Senese*, *Mora Romagnola* and *Casertana* seem to show higher body size and faster growth rate. The link with free-range rearing increases the commercial value of products of local pigs, because of both effective characterization and consumer suggestion, but research is helpful to increase the knowledge of their rearing system. The more interesting fields of research seem the following: genetic traceability; feeding traceability; evolution of body composition; sustainable exploitation of natural resources.

Key words: Italian autochthonous pig, Genetic management, Reproductive traits, Productive traits, Research perspective.

RECENT HISTORY OF ITALIAN AUTOCHTHONOUS PIG – At the beginning of the XX century there were twenty-one local pig breeds in Italy (Mascheroni, 1927). The socio-economical post-war transformations in the agricultural system, the intensification and industrialisation of pig farming, the modification in land use and the massive utilisation of foreign high productive breeds determined the decline of importance of the local breeds. With respect to Northern Italy, where extensive farming with local breeds started to disappear early last century, Italian pig breeds showed in Insular, Southern and Central Italy a higher resistance to their substitution with the commercial breeds. However, in the second half of the last century the process of decline accelerated, leading most of the local pig breeds to lose their individual identities and finally to extinction. Nowadays only five Italian local breeds are still farmed. These are *Mora Romagnola*, *Cinta Senese*, *Casertana*, *Calabrese* and *Nero Siciliano*. In addition, a heterogeneous local pig population is still present in Sardinia, which recently (2006) received the recognition as autochthonous breed (*Sarda*) with the definition of its morphological standard and the recording in the National Pedigree Register. It's probably that local Italian breeds belong to the Mediterranean type or, alternatively, are intermediate between European and Indochinese pigs (Porter, 1993). The Mediterranean type includes also other breeds of the Mediterranean Basin, as those reared in South of Spain, Portugal, South France and Corse, and it is characterized by a coloured coat and a high tendency for fat infiltration into muscle fibre (Delgado *et al.*, 2001).

MANAGEMENT OF PIG GENETIC RESOURCES IN ITALY – In the seventies-eighties the conservation and safeguard of the endangered Italian pigs were assured by the will of few breeders and by sporadic initiatives of some public institutions. Owing the increased public interest for the safeguard of autochthonous germoplasm, the preservation of the local pig breeds has been carried out at national level with the aim to define the standard of individual breeds and to recover parents within populations. The National Pedigree Register (Registro Anagrafico)

of local genotypes was recently set up (D.M. 20871; 6/3/2001) by the Italian Pig Breeders Association (ANAS) at the request of the Ministry for Agricultural Politics. At the moment, the Register includes sections for six Italian breeds: *Mora Romagnola*, *Cinta Senese*, *Casertana*, *Calabrese*, *Nero Siciliano* and *Sarda*.

Table 1. Demographic situation of Italian breeds in the last years, according to National Register.

	year	Mora Romagnola	Cinta Senese	Casertana	Calabrese	Nero Siciliano
Boars ⁽¹⁾	2004	41	258	12	20	29
	2005	60	231	11	18	34
	2006 ⁽⁴⁾	49	166	18	19	25
Sows ⁽²⁾	2004	112	1137	26	53	175
	2005	128	1031	30	57	148
	2006 ⁽⁴⁾	141	846	66	65	144
Herds ⁽³⁾	2004	33	220	4	7	21
	2005	36	195	9	7	24
	2006 ⁽⁴⁾	37	153	10	12	22
Sows/boars	2004	2.73	4.41	2.17	2.65	6.03
	2005	2.13	4.46	2.73	3.17	4.35
	2006	2.88	5.10	3.67	3.42	5.76

(1) Males which mated at least once in the year.

(2) Females which farrowed at least once in the year.

(3) Herds with reproductive activity in the year.

(4) Data in 2006 are incomplete.

The demographic situation of five breeds is reported in table 1 that consider only animals and herds recorded in the Pedigree Register in the last three years. However, for some breeds (*Nero Siciliano*, for instance) the size of population is greater since it results difficult to identify and to register standard animals in the free-range system. Moreover, for *Sarda* there are not any demographic information derived from Pedigree Register, because of their recent recognition, but a survey on the mountain regions of Sardinia estimated in several thousands the pigs attributable to the *Sarda* breed (Porcu, 2007; personal communication). The evolution of the size of the five breeds over the three years shows a moderate increase for the smallest population and a general decrease for the biggest ones (i.e. *Cinta Senese*) which probably suffers the search of equilibrium with the niche market of its products. It is noticeable the low sows/boars ratio that increases the rearing cost in this system but, on the other hand, it assures the maintenance of the genetic variability and can limit the increase of the inbreeding level, inevitable in small populations. The natural mating, moreover, imposes the presence of at least one boar per herd, irrespective to the size.

All the breeds are mainly reared in the original area but *Cinta Senese* is spreading out of Tuscany. Probably it is due to the more precocious recover of this breed, which has been registered in the national herd-book for the first time from 1936 to 1966 and again in a regional herd-book since 1976. This registration provides important information about genetic structure of the present population of *Cinta Senese* and allows, at present, to know a deep pedigree and to describe the evolution of the breed in the last thirty years. However, a very narrow bottleneck was experienced in the 1980's for *Cinta Senese* due to the low number of animals registered per year (3.6) and of founders (29); as a consequence inbreeding is very high in the breed (Gandini *et al.*, 2000). Except for *Nero Siciliano*

breed, which maintained high genetic variability owing to effective population size (1500-2000 pigs) (Chiofalo and Liotta, 2003), the situation of the other breeds is analogous to that of *Cinta Senese*.

Because of their small size and the opportunity to valorise their typical traits, the genetic management of the Italian local breeds aims to maintain the original genotypes without any selective project, as it is well declared in the aim of the Pedigree Register. At present it is very urgent to adopt programs of mating management with the aim to increase the genetic variability and to reduce the inbreeding. This process determined in *Cinta Senese* a lowering of inbreeding coefficient from 0.21 in 1996, to 0.17 in 1999 and 0.14 in 2003 (Gandini *et al.*, 2000; Gandini and Gallo, 2004). However the six breeds are not in the same situation. *Nero Siciliano* and *Sarda* populations have fair size and show higher variability than the other local breeds. In these breeds it is necessary the individuation of morphological standard and the recovery of appropriate genotypes to fix the typical traits. Similar problem exists, for instance, in Corsican population which shows high variability because of the uncontrolled mating as consequence of free-range rearing (Casabianca *et al.*, 2000).

REPRODUCTIVE PERFORMANCE – Reproductive performances of the breeds are reported in table 2, as obtained by ANAS through the functional recording of the National Register in the 2006. For this reason the *Sarda* pig is excluded from the table, but a recent survey (Porcu, 2007; personal communication) recorded for this breed a litter size at birth of 7.3 piglets, similar to the other local breeds. For comparison, the analogous data obtained in Large White is shown in the table. The statistics confirm the low reproductive ability of these breeds in comparison with the improved ones, though performance of these breeds should be interpreted with caution because of the difficulty to record reproduction data in the free-range system, the practice of crossbreeding which leads to few purebred litters and, finally, the limited number of sows mated per year. However, the performances of Italian autochthonous breeds are similar or better than those of other Mediterranean pig breeds, as Iberian pig which produces, on average, 6.45 and 6.07 piglets at birth and at weaning, respectively (Barba *et al.*, 2001).

Table 2. Reproductive traits in the Italian pig breeds recorded by ANAS in the 2006.

	Litter size at birth		Litter size at weaning	
	no.	$\mu \pm \text{s.d.}$	no.	$\mu \pm \text{s.d.}$
Mora Romagnola	165	7.13 \pm 2.58	152	5.47 \pm 2.41
Cinta Senese	894	7.00 \pm 2.13	817	6.08 \pm 2.15
Casertana	80	7.26 \pm 3.22	58	4.91 \pm 2.76
Calabrese	59	6.12 \pm 2.64	40	5.45 \pm 2.35
Nero Siciliano	130	6.78 \pm 1.22	88	6.02 \pm 1.60
Large White	10027	11.24 \pm 2.54	8505	9.68 \pm 1.73

On overall, the small litter size in Italian breeds might be related both to inbreeding depression and to poor management, besides the additive genetic effect. For litter size at birth and at weaning, inbreeding depression is evident in *Cinta Senese* (Crovetti *et al.*, 2005) and remarkable difference (1.5 piglets per litter) was found between purebred litters and crosses sired by Large White boar. The poor management is often linked to outdoor system which, contrarily to intensive system, reduces the employ of tools for the control and safeguard of the litters. However, selection of sows for maternal ability is conducted only by the individual breeder since the Breeders Association, at moment, requires only a minimum of 10 functional teats, for the inscription of animals in the Pedigree Register. It should be possible in the future to elevate this threshold, if it happens as in *Cinta Senese* where about the 10% of litters has more than 10 born alive piglets.

Productive performances and meat quality - Productive performances of Italian autochthonous breeds have been investigated by several Authors in recent years. Some study compared the local pigs with the improved ones, so it is possible to verify the real gap between the two genetic types and to evaluate the effect of the genetic improvement in swine in the last century. Other works studied the effect of rearing system (indoors vs. outdoors) on productive traits (e.g. growth) and on qualitative characteristics of meat and fat in local breeds. Few works compared the Italian breeds among themselves, but it is a marginal issue since the strong link between breed and territory, as the commercial value is concerned, makes unlikely the competition of the local breeds among themselves. A com-

parative review is arduous to conduct and should be interpreted with caution since the examined trials are carried out in different conditions particularly when animals were reared outdoors. However, an overview of principal characteristics of this breed can be useful.

Table 3. In vita performance of the five local breeds reared intensively with commercial feed.

Author	Breed	Age (d)	Slaughter weight (kg)	ADG ⁽²⁾ (g/d)	Feed/gain ⁽³⁾
Acciaioli et al., 2002	Cinta Senese	312	136	436	4.54
	Large White	259	154	595	3.77
Pietrolà et al., 2006	Casertana	367	151	411	5.13 ⁽⁴⁾
	Large White	297	179	603	3.15 ⁽⁴⁾
Fortina et al., 2005	Mora Romagnola	514	193	375	4.25
	Casertana	494	200	409	4.20
Pugliese et al., 2003	Nero Siciliano	448	102	228	
Cosentino et al., 2003	Calabrese ⁽¹⁾	540	134	248	

⁽¹⁾ Managed in free range system.

⁽²⁾ Calculated as weight/age.

⁽³⁾ During the growth-fattening phase.

⁽⁴⁾ Personal communication.

In table 3 some parameters concerning in vita performance are reported. To allow evidence of effective genetic potential and to compare results among the breeds, only data obtained in the intensive condition are reported. The slaughter weight varied among breeds in order to obtain mature meat, suitable for ham and salami production, according to the growth rate of each breed.

On *Cinta Senese* (Acciaioli *et al.*, 2002) and *Casertana* (Pietrolà *et al.*, 2006), a comparison with Large White has been carried out under intensive management. As expected, the result appears severe and quantifies the wide difference in the productive performance between the local and the improved pigs. Both *Cinta Senese* and *Casertana* reached the target slaughter weight 2-3 months later than Large White, with a growth rate slower of about 30%, and showed worse feed conversion for 1-2 kg of feed per kg of gain. Consequently their biological efficiency appeared very low and their rearing very expensive. Growth rate of *Mora Romagnola* pigs was analogous to that of *Cinta Senese* and *Casertana*. Within the local pig group, those breeds have appreciable body size. The higher growth rates recorded for *Cinta Senese* is probably due to genetic improvement occurred since 1936 until 1966 when, alone among the Italian breeds, it had herd-book and selective scheme. *Calabrese* and particularly *Nero Siciliano* pigs, are characterized by smaller body size and lower growth rate, though the rearing system might have influenced their performance. Despite of the comparison with the improved breeds, it is noticeable that in *Cinta Senese*, *Casertana* and *Mora Romagnola*, under intensive management, it is possible to reach the slaughter weight at around one year of age, that assures adequate maturity of meat for the seasoning processes. Data on the performance of *Sarda* are lacking again, but its body size seems to be similar to *Nero Siciliano*.

The slower growth rate of *Cinta Senese* in comparison to Large White determines (and it is determined too by) different pattern in the development of tissues with a marked tendency to fatness, that is common to the other rustic pigs (table 4). At high live weight, carcass of local breeds is covered of thick subcutaneous fat and, at some localizations in *Cinta Senese* (Franci *et al.*, 2003) and in *Nero Siciliano* (Pugliese *et al.*, 2003), backfat thickness can measure even 5 cm. As reported in table 4, *Cinta Senese* carcasses showed plus 50% of fat cuts than Large White; *Nero Siciliano* carcass, dissected with the same "Modena" dissection method, had higher percentage of fat cuts than *Cinta Senese*, in spite of the lower slaughter weight. The other results of the table 4, even if obtained with different dissection system which does not separate backfat from loin with consequent overestimate of total lean cuts percentage, confirmed the high fatness of the local breeds, particularly of *Calabrese* and *Nero Siciliano*.

Table 4. Carcass composition.

Author	Breed	Weight (kg)	Dressing (%)	Lean cuts (%)	Fat cuts (%)	Bone cuts (%)
Acciaioli et al., 2002 ⁽¹⁾	Cinta Senese	136	81.2	57.7	36.8	5.1
	Large White	154	82.8	69.1	24.7	4.9
Pietrolà et al., 2006	Casertana	151	81.4			
	Large White	179	79.8			
Fortina et al., 2005 ⁽¹⁾	Mora Romagnola	193	80.4	59.7 ⁽³⁾	34.5 ⁽³⁾	5.8 ⁽³⁾
	Casertana	200	82.3	55.8 ⁽³⁾	39.3 ⁽³⁾	4.8 ⁽³⁾
Pugliese et al., 2003 ⁽¹⁾	Nero Siciliano	102	82.5	53.8	39.4	6.6
Grasso et al., 1996 ⁽²⁾	Casertana	125	86.0	77.7	12.7	8.8
	Landrace x (LxLW)	125	84.6	80.6	9.9	8.6
Colatruglio et al., 2000 ⁽²⁾	Calabrese	176	81.5	78	15	
	Cinta Senese	173	81.0	79.2	13.7	
	Nero Siciliano	166	80.6	79	14.2	

⁽¹⁾ "Modena" dissection method.

⁽²⁾ "Napoletano" dissection method.

⁽³⁾ our re-elaboration.

As regard qualitative traits of meat there are few available results but some considerations are possible. Generally, the Mediterranean pig breeds seem to be free from the halothane gene, as reported by Matassino *et al.* (2000) in *Calabrese*, *Casertana* e *Nero Siciliano* and by Ramos *et al.* (2000) in Manchado de Jabugo breed. However in *Nero Siciliano* and in *Cinta Senese* Russo *et al.* (2004) and Crovetto *et al.* (2007a), respectively, found a very low frequency of 1843T allele at RYR1 locus while in the French local breeds a large variation of frequency (from 0 to 44%) of the same halothane-sensitive allele was found by Labroue *et al.* (2001).

Table 5. Meat quality traits.

Author	Breed	pH ₄₅	L*	a*	b*	IMF %	Cooking loss %
Franci et al., 2005 ⁽¹⁾	Cinta Senese	6.22	49.7	11.4	4.62	3.19	26.0
	Large White	6.31	51.4	9.17	4.48	0.90	33.2
Fortina et al., 2005 ⁽¹⁾	Mora Romagnola	6.57	42.3	8.74	2.24	6.1	
	Casertana	6.38	43.3	9.39	2.59	4.7	
Pugliese et al., 2004 ⁽¹⁾	Nero Siciliano	6.29	46.7	15.32	4.88	3.3	25
Zullo et al., 2003 ⁽²⁾	Casertana				3.88		
	Landrace x (LxLW)				2.31		
Palazzo et al., 2000 ⁽²⁾	Calabrese	37.7	17.4	9.5			
	Cinta Senese	34.9	16.3	8.6			
	Nero Siciliano	34.9	17.0	8.9			

⁽¹⁾ On *Longissimus lumborum*.

⁽²⁾ On 5-9 different muscles (average value).

These investigations indicate the possibility of some introgression of the HAL gene from the commercial breeds (Landrace o Pietrain) into several local breeds and suggest the importance of recovering the primitive germoplasm and of monitoring the local populations to avoid the use of indiscriminate crossbreeding, as it happened during the period of severe reduction of their size. However, as shown in table 5, pH₄₅ values, well over the critical threshold of 5.9, confirmed the hypothesis of general absence of HAL gene in the Italian pig breeds. About other candidate genes for meat production and quality traits the situation of the autochthonous breeds in comparison with the improved ones is less definite (Russo *et al.*, 2002; Russo *et al.*, 2004; Davoli *et al.*, 2006; Crovetto *et al.*, 2007a), but all the *Cinta Senese* animals examined by Crovetto *et al.* (2007a) were homozygous for the *R200* allele of the *PRKAG3* gene confirming the absence of the acid meat defect (RN⁻) in the breed.

Among the qualitative traits of meat (table 5), intramuscular fat content seems the best discriminator to separate the local pigs from the improved ones. *Cinta Senese* and *Nero Siciliano* showed IMF content higher than 3% in *Longissimus*, that is muscle with moderate fatness. The corresponding value in Large White was lower than 1%. In *Casertana* and in *Mora Romagnola* IMF content was even higher, because of the high slaughter weight. It is well known that in some muscles of local breeds the fat content can reach the value of 10% as found in Iberian and Corsican pig reared outdoor (Mayoral *et al.*, 1999; Coutron-Gambotti *et al.*, 1998). Considering the findings of some Authors (Molenat *et al.*, 1992) that the organoleptic traits of meat are linked to a minimum content of intramuscular fat (2-2.5%), it is evident that the genetic improvement toward high fleshiness in swine reduced the incidence of fat depots, the intramuscular one inclusive, and worsened the meat quality. So local pigs are a valuable genetic reserve to utilise for recovering organoleptic properties of pig-meat lost because of severe selective programs. Because of the high fat and the high age at slaughter, as consequence of low growth rate, meat of Italian local pigs is more red and less bright and had lower cooking loss than the improved ones. Among the local breeds, *Calabrese* and *Nero Siciliano* furnish meat more red than *Cinta Senese*. The higher water holding capacity showed by *Cinta Senese* pig in comparison to Large White determined, moreover, lower loss during salting and seasoning of ham.

Table 6. Fatty acid composition (% on total fatty acids) of backfat.

Author	Breed	C18:0	C18:1	C18:2	SFA	MUFA	PUFA
Franci <i>et al.</i> , 2005	<i>Cinta Senese</i>	10.51	50.3	9.5	36.2	53.2	10.4
	Large White	11.95	48.6	10.1	37.6	51.2	11.1
Fortina <i>et al.</i> , 2005	<i>Mora Romagnola</i>	15.42	43.55	10.33	41.31	47.63	11.04
	<i>Casertana</i>	13.74	43.05	11.07	39.97	48.23	11.78
Pugliese <i>et al.</i> , 2004	<i>Nero Siciliano</i>	10.93	42.9	9.18	38.3	47.2	14.4
Cosentino <i>et al.</i> , 2003	<i>Calabrese</i>	12.46	39.41	11.72	37.61	48.73	13.66
	<i>Casertana</i>	10.95	40.71	9.58	37.25	51.5	11.29

As regard fatty acid composition of fat, comparison among the Italian breeds is difficult because of the few available data and the different depots and localizations analysed. A summary of some results are shown in table 6, but the discussion must be done with caution considering the different conditions of the trials. According to Gandemer *et al.* (1990) local pigs should have higher predisposition to depot oleic acid whereas improved pigs depot higher quantities of saturated fatty acids or, in the case of extreme leanness, of linoleic acid. These findings are confirmed in the comparison between *Cinta Senese* and Large White reared in the same experimental conditions. However, it is well known that fatty acid composition is highly affected by rearing and feeding conditions; this strong linkage is well exploited for Iberian pig products which are classified according to their fatty acid composition that discriminate the commercial value of products in three types: Montanera, Recebo and Cebo (Lopez-Bote, 1998).

PERSPECTIVES IN THE RESEARCH FIELD – The limited experimental information on the Italian autochthonous pig stimulates to undertake researches for this particular pig system, in which only few results obtained on the improved pig can be transferred. It is noticeable that the productive system of the Iberian pig is sustained by an adequate research activity, that produced in the last ten years more than 90 articles in scientific journals. According to our knowledge, mainly based on the productive system of *Cinta Senese* pig, the following items of research can be proposed as priority.

Genetic traceability – Besides their intrinsic characteristics, the product of the local pig is highly valued because of the link to the particular breed and geographical area. For *Cinta Senese*, a niche market of some interest has been recognised, but recent survey (Dini and Michelotti, 2004) indicates the existence of several problems linked to herd size, price stability, critical mass of supply, standardization and traceability of the products. Part of the problems should be solve with the creation of protection Consortium and the recognition of DOP. In this perspective local breeds should profit of genetic traceability of their products. The major risk is the introduction of fraudulent product obtained from the improved breeds and relative crosses with economic damage for the breeder's and survival risk for the local breeds. On some of these breeds, researches to assure the genetic traceability are conducted. Crovetto *et al.* (2007b) studied the coat colour genes of *Cinta Senese* to distinguish this belted breed from the most widespread genotypes reared in Italy. Other ways, besides the single gene breed-specific, can be explored using microsatellites and/or SNP's (Single Nucleotide Polymorphisms) that are the most common markers of DNA in the animal genome (one each 150-500 nucleotides).

Feeding traceability – The linkage of products of local pigs with natural resources and free-range rearing increases their commercial value both for a effective characterization and for consumer suggestion. Probably, the typical production of Italian pigs should be characterized in the similar manner as the Iberian pig products, classified according the feeding system in the fattening period, as above mentioned. In *Cinta Senese*, Pugliese *et al.* (2005, 2006a) indicated some differential qualitative aspects in meat and seasoned products between indoors and outdoors pigs even if the strong characterization occurs when pig pastures on acorn and chestnut (Pugliese *et al.*, 2006b).

In view of a commercial classification of the products of autochthonous breeds, according to feeding system, it's necessary to individuate alternative methods of feeding traceability. The verified differences in fatty acid composition according to feeding system (Pugliese *et al.*, 2006b) can characterize the sensorial and organoleptic traits of the products but a traceability system based on fatty acid composition is not suitable for the aim. In fact it's easy to formulate diets which simulate the fatty acid composition of the wood products. Thus innovative methods should be directed towards the identification of tracer molecules. At this aim some techniques such NIRS, NMR, GC-MS could be suitable to the aim.

Evolution of body composition – It is well known that as age and/or weight increase, swine body modifies its composition as consequence of differential growth of organs, tissues and regions (Geri *et al.*, 1984a,b). Therefore, the incidence of various lean and fat cuts can vary greatly with the slaughter age and with the feeding plane adopted. This issue is important in the improved breeds, but it becomes priority for the autochthonous genotypes which are reared according systems linked to productive rhythms of the natural resources, and the feeding planes can favour or mortify the tissues development depending to growth phase. Again, in the perspective of suitable employment of the natural resources in characterizing the final pig product, it is mandatory the knowledge of the allometric development of body of the local breeds with the adoption of feeding planes simulating those used practically to synchronise the rearing at the availability of the natural resources.

Sustainable exploitation of natural resources – The fate of these breeds and their commercial outcome are linked to outdoors rearing and to use of natural resources. The latter are limited and must be destined exclusively to the slaughter animals in the finishing period when their influence on the characteristics of final product is maximum, with the consequent economical outcome. Nevertheless, as pointed out by Fabbio *et al.* (2004) in relation to impact of free-ranging of *Cinta Senese* on natural resources, some caution must be used in wood pasture with pig. The sustainability of grazing in the forest is clearly supported by acorns availability but it needs to be taken into duly account that: i) pigs feed other vegetable components (tubers, rhizomes, roots, bark, apical shoots); ii) grazing action and research for food produce soil trampling and digging out; iii) these harmful effects occur in a very sensitive environment as the dense forest, quite different from the open stands already present in the past and managed with the targeted purpose of grazing. These are the reasons why, whether fruit production and its availability throughout the year are the basic determinants for the calculation of the theoretical number of animal units, it needs to be validated by the early analysis of possible damages to forest soil and vegetation. Authors suggested to limit the pasture of pigs into the forest only in the fruit fall period. Only a careful management of exploitation of natural resources will allow to Italian local pigs to survive with qualified production without compromising the sustainability of natural environment. It is mandatory the development of multidisciplinary researches to individuate the equilibrium point between local pig rearing and sustainability of natural resources in the numerous Italian environments.

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