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Oak stands productivity and rearing of Cinta Senese in central Tuscany

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SUMMARY – Renewed attention is nowadays being paid to the Cinta Senese, a local breed of pig native to the area of Siena (central Tuscany). Historically, its typical rearing environment included oak stands, the forest fruits being considered fundamental to characterize the quality of production. Given that the structure of the current forest types is very different from the stands managed in the past for this purpose, both acorn production and the period of fruit fall were monitored throughout four years in three sites around Siena. The most common oak forest types in the area, i.e., *Quercus ilex, Quercus cerris* and *Quercus pubescens* stands were considered. The period of fruit fall was September-March (holm oak); September-January (Turkey oak); whilst pubescent oak, which builds up the more degraded stands in the area, showed a very low and not significant acorn production. Finally, the sustainability of grazing under the forest cover is discussed.

Keywords: Cinta Senese pig, silvopastoral system, oak forest, acorn.

RESUME – *"Productivité des forêts de chênes et élevage du porc Cinta Senese dans le centre de la Toscane". Aujourd'hui la Cinta Senese, une race porcine locale du territoire de Sienne (Toscane centrale), est l'objet d'un nouvel intérêt. Historiquement son milieu d'élevage typique comprenait des chênes, les glands étant considérés comme fondamentaux pour caractériser la qualité de la production de la Cinta Senese. Comme la structure des forêts actuelles est très différente de celle des forêts gérées par le passé dans ce but, la production de glands et leur époque de chute furent enregistrées pendant quatre années, dans trois localités près de Sienne. On a considéré les types de forêts de chênes les plus répandues dans la zone, i.e.* Quercus ilex, Quercus cerris *et* Quercus pubescens*. La durée de la chute des glands fut: Septembre-Mars* (Quercus ilex)*; Septembre-Janvier* (Quercus cerris) *alors que Quercus pubescens, qui constitue les bois les plus dégradés dans la zone, a eu une production de glands insignifiante. Enfin la durabilité du pâturage en forêt est discutée.*

Mots-clés : *Porc Cinta Senese, système sylvopastoral, forêt de chênes, gland de chêne.*

Introduction

The practice of livestock farming under the forest cover, *i.e.* one facet of the multiple use of Mediterranean forests, often became the major determinant of forest tranformation into open woodland (Martin *et al*., 2001), but created also silvopastoral systems (*e.g*. dehesas, montados) nowadays perceived as "natural" because of their agreeable physiognomy originating aesthetically effective rural landscapes (Fabbio *et al*., 2003). The renewed interest for traditional uses of local resources is a general trend of the current EU policies for the development of rural areas but also the concern of farmers and private owners, aimed at getting an added value from their productions (Amorini *et al*., 1980; Amorini and Fabbio, 1990; Fabbio and Amorini, 1990). The rearing of a local breed of pig, the Cinta Senese, diffused up to mid-20th century over the area around Siena and surrounding provinces, may be considered in this context. The Cinta Senese breed, native of the "Montagnola senese", the hilly environment West of Siena, was originally reared extensively with the acorns of oak trees, that represented the typical forests in the area (Dondi, 1924; Dal Pra, 1951). The diffusion of the sharecropping system produced at first the spreading of this practice; its decline led to the ending of the rearing system. Each estate (the farm) consisted of 300-500 hectares subdivided into 15-20 holdings (Dondi, 1924). The unsown fields and the forest cover were two/thirds of each holding, only one/third being the ploughed fields (Tornar, 1950). Such a land use allowed both sheep and pig breeding on a large share of the holding area, also residuals from the agricultural crop harvesting and open rangelands being pastured. As far as pig rearing is concerned, a series of complementary resources was therefore available throughout the year, the grazing of forest fruits being generally limited to the fall period in the autumn-winter season. Nowadays the practice of a minimum pannaging

time under forest cover is recommended, as this will result in an optimum use of natural resources (Benito-Hernández *et al.,* 1993). The plantation of oak trees on the border of sown fields, especially targeted to fruit production (Fig. 1), has been a customary practice in the area since the XVIII and XIX century as reported by Piussi (1980), Zanzi-Sulli and Di Pasquale (1993), Hippoliti (2001). Furthermore, the management of a share of forests was especially addressed to establish suitable conditions for animal husbandry. The natural, dense oak cover was reduced accordingly to a few scattered trees (Fig. 2), to allow the growth of wide crowns and a high acorn production. The number of trees per hectare varied from 80 to 150 as a function of the site-index (Bernetti, 1987). The forest floor was in this way free from vegetation (the undergrowth was harvested on short rotations for firewood production) and thus able to grow an herbaceous layer. The original forest physiognomy was transformed into a forested rangeland, where both sheep and pigs could find suitable grazing and nourishment.

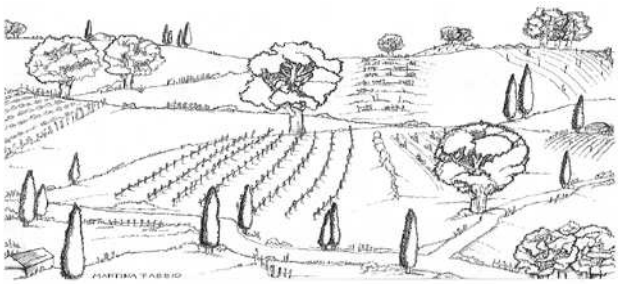

Fig. 1. The typical landascape around Siena with scattered big oaks along the border of the fields.

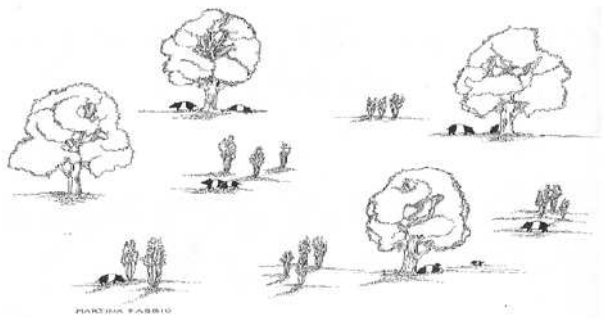

Fig. 2. The open structure of a grazed oak wood up to the mid-XX century.

Detailed technical notes about the past management system are reported in literature or in historical records. A ratio of 4000 oaks to 300 animal units is cited by De'Ricci (1830); one animal unit per 1-2 hectares over 2/3 of the year in a holm oak forest is quoted by Pavari (1930). The carrying capacity of the oak stands managed for pig nourishment (the "grazed oak woods") was on average of three animal units per hectare per one month in the 1950's according to (Bellucci, 1953); 40-45 pigs over 30 hectares in the fall period (3-4 months), with a *per capita* acorn consumption of 500 kg are reported by Dondi (1924). Several authors underline anyway the highly variable carrying capacity of these silvopastoral systems, which depends mostly on the yearly fruit production. According to Marinelli (1979), the harvesting and conservation of fruits from the big oaks grown either on field borders or isolated across the sown fields was a common practice, complementary to forest floor grazing.

Measurements of acorn production per tree are scarce in literature; the following values: 0.1; 3.0; 16.3 kgs were measured by Corona *et al.* (1986) at the ages of 24, 50, 75 respectively. Acorn production grows exponentially with tree age (*i.e*. tree size).

Nowadays these forested rangelands, no more used for the original purpose since the last mid-century, have evolved again into much denser woods (Fig. 3), the growth of a dominated layer being left undisturbed for a quite long time and the main crop layer (old trees with large crowns devoted to acorn production) being already over mature or decaying.

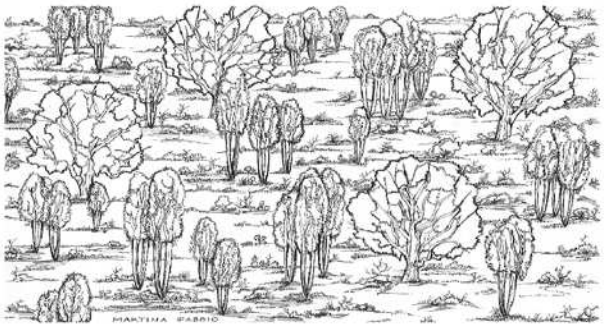

Fig. 3. The same stand drawn in Fig. 2 fifty years after the suspension of forest harvesting and use with pasture.

Given the renewed interest in the use of the oak forests for pasture, the problem is now to get a reliable estimate of the actual acorn production in the stand types concerned. At the same time, the proposal to reconsider a traditional use of forests already deleted in any forest regulation, needs first the assessment of the sustainability of this practice under the current, generally acknowledged assumption, of an eco-compatible use of natural resources (Di Castri, 1996; Fabbio *et al*. 1998).

The aims of the undertaken research trials were therefore: (i) to determine the acorn production of oak stands, *i.e*. the carrying capacity of these ecosystems in terms of pasture; and (ii) to discuss the sustainability of this practice under the current rules of forest management and the updated frame of environmental protection.

Materials and methods

Three forest typologies, the most diffused in the potential area concerned with the Cinta Senese rearing, were considered: (i) a holm oak forest located on the slopes of the "Montagnola senese"; (ii) a Turkey oak-dominated forest where the main crop layer is built up by adult, wide-crowned trees located in the hilly area surrounding Siena; and (iii) an open-grown pubescent oak stand, close to the previous site, showing a reduced site-class (small-sized trees with very small crowns) because of the past overexploitation and the concurrent disturbances of forest fires. It leads the forest and the associated shrubby vegetation to early successional stages repeatedly. This is the most common condition of pubescent oak-dominated forests, usually prevailing on southern slopes and the driest sites.

The acorn production was monitored over four subsequent years and throughout the entire fall time by the litterfall traps method, *i.e.* 1 m^2 traps systematically arranged in the plot area. The harvesting of acorns was made every fifteen days in the fall period. The fresh and dry weight of the acorns collected inside each trap were determined in the lab, and the amount of fruit production per unit area (hectare) at the time of each collection and as a total per year, were calculated.

Results and discussion

Acorn production is shown in Fig. 4. Data highlight: (i) the marked difference among the species, which depends on the different age of trees basically; on the individual crown development (*i.e*. the stand structure) and on the site-index; (ii) the high variability of fruit production over subsequent years, it being a natural feature of forest stands that also depends on the climate conditions in the previous (flowering) and current year (fruit ripening); and (iii) the different intensity and length of fruit fall according to the species (Table 1). Values in the Table highlight both the concentrated fall for the deciduous oak (3-4 autumn months) and the longer fall time for the evergreen oak (7 months).

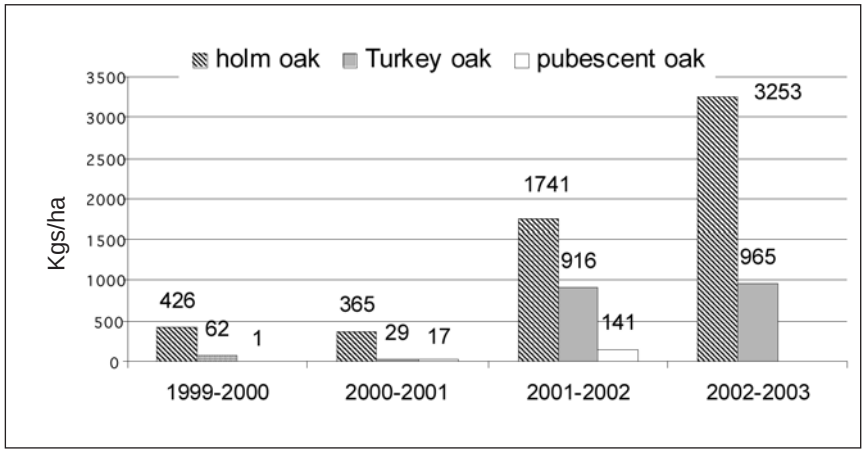

Fig. 4. Annual acorn production (fresh weight) for each species (site) over the observation period.

Table 1. Acorn production (fresh weight kgs) over the seasons 2001-02 and 2002-03. The monthly amounts and the length of fall time are highlighted both for the evergreen and deciduos oak

Species	Year	Sept.	Oct.	Nov.	Dec.	Jan.	Febr.	March
Holm oak	2001-02	140	216	338	107	661	212	66
	2002-03	24	633	1116	1206	0	274	0
Turkey oak	2001-02	360	207	340	8	1	0	0
	2002-03	8	184	763	9	0	5	0

The observation time does not include two clearly identifiable event years *i.e.* the natural repetition of heavy acorn productions (a two-three year interval is quoted in literature on average, but large deviations may occur naturally).

The last season (2002-03) may be considered as an event year due to the large amount of fruits observed also on trees scattered in the fields all over the concerned area. Under this assumption, these values may be regarded as the current maximum available at the moment in the more diffused oak forest types. The poor production, occurring in the first two years as compared to the following period, underline the high yearly discrepancy. The extremely low values observed for pubescent oak point out the effect of a limited residual carrying capacity on fruit production too.

Conclusions

Current acorn productions are, as a matter of fact, less abundant than those available when oak management was especially addressed to the purpose of livestock farming. The size of crowns, *i.e.* the parameter related to acorn production, is on average much smaller and the dominant age of forests is younger. The forest environment itself is much less favourable to animal rearing because of the higher tree densities and the growth of a dense shrubby layer.

Given these structural conditions, the carrying capacity in terms of pasture for pigs is reduced and suggests a limitation of the period of nourishment under the forest cover to the time of acorn fall. Furthermore, high variation in production every year calls for flexible management rules, which mean the annual rearing of a varying amount of animal units or the availability of a large forest area, able to provide the requested feeding in the less favourable years too. On the other hand, the latter condition, *i.e*. a wide forest cover, clashes with the small sized properties in the area. Under these assumptions, the role of forest is clearly depicted as a complementary resource in a prevailing rearing environment made up of open rangelands and sown fields, the residuals of agricultural crops being a further

resource. As a consequence, the strategy of foreseeing supplementary, external feeding should be a basic rule for the Cinta Senese management.

As far as the sustainability of livestock farming is concerned, the goal of the undertaken research trials was addressed to evaluate only a quantitative aspect of the problem *i.e*. the carrying capacity of a forest system in terms of feeding. A series of underlying issues should be duly taken into account for the purpose. The animals (pigs in this case) exert, besides the acorn harvesting, a noteworthy influence on the forest soil (excavation of tubers, rhizomes, roots, small animals) and on the ground vegetation (bite of bark and apical shoots) due both to the quest for food and to their roaming. It results in the digging out and the trampling of the soil in a very sensitive environment (the forest) which naturally has a reduced carrying capacity of fauna. That is why, in our opinion, the determination of fruit production provides only one parameter; the early warning of damages may be the bio-ecological signal that the threshold of a theoretical carrying capacity has been exceeded. In this sense, further research trials are needed.

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