

CHESTNUT ORCHARDS IN EMILIA-ROMAGNA SEQUESTER ORGANIC CARBON IN THE SOIL



CASTANI-CO

EXTRACT FROM THE PAMPHLET “CHESTNUT ORCHARDS IN EMILIA-ROMAGNA SEQUESTER ORGANIC CARBON IN THE SOIL”

The complete version in Italian can be found at the link: <https://www.pedologia.net/it/CASTANI-CO/cms/Pagina.action?pageAction=&page=InfoSuolo.41&localeSite=it>

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PHOTOS

I.TER ETHNOS Archive

Thanks to:

The Project partners

S.S Menetti's Terra Amica Farm

Marco Picciati's Teggiolina Farm

Stefano Fogacci's Tizzano Farm

Monari & C.S.S. Farm

Daniele Canovi's Antico Bosco Farm

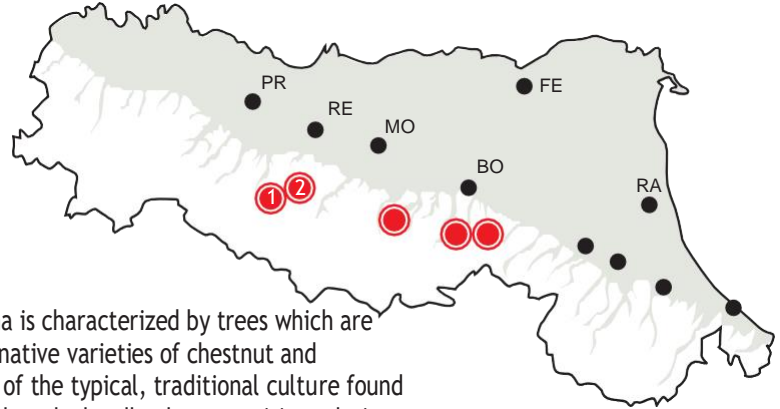
Consortium of Chestnut Growers in the Apennines of Bologna

Consortium of Chestnut Growers in the Apennines of Reggio

National Association City of the Chestnut Tree

Giovanni Mami di Grafikamente Ltd. for the pamphlet's graphics.

The Project CASTANI-CO



Traditional chestnut cultivation in Emilia-Romagna is characterized by trees which are often hundreds of years old, mainly grafted with native varieties of chestnut and marrons, as well as stable, untilled soil. It is part of the typical, traditional culture found in the mountainous areas of Emilia-Romagna which undoubtedly plays a positive role in the range of strategies to mitigate climate change due to the potential to accumulate carbon in the soil and trees. Furthermore, cultivating chestnuts produces very few greenhouse gas emissions, if any, as the limited use of machinery is confined to pruning and sometimes harvesting with vacuuming harvesters.

Analogously to the situation all over Italy, traditional chestnut orchards in Emilia-Romagna have been exposed to a slow and constant crisis caused by the presence of parasites and repeated unfavourable meteorological events, which over time have led to chestnut cultivation being abandoned. Despite the marked reduction in the areas cultivated, chestnut producers in the Emilia-Romagna Region are very active and have organised specific groups of producers to promote chestnut cultivation, cultivation techniques, specific local varieties and the territory which produces them. CASTANI-CO, a three-year project funded by the Emilia-Romagna Region for the purposes of Measure 16 of the RDP 2014-2020, came into being in response to the need to learn more about carbon sequestration by the soil and plants in order to identify which cultivation techniques can increase it. A study of the soil was set up, through observations in the field, sampling and chemical analysis in the chestnut orchards of partner farms located in pedologically different environments. The results have been used to identify and share the “guidelines to improve the management of traditional chestnut orchards in order to obtain a high-quality product and promote carbon sequestration”.

KEY	PARTNER FARM	BOROUGH	ALTITUDE
1	Marco Picciati's Teggiolina Farm	Carpineti	730 m MSL
2	Daniele Canovi's Antico Bosco Farm	Marola	746 m MSL
3	Stefano Fogacci's Tizzano Farm	Zocca	640 m MSL
4	S.S Menetti's Terra Amica Farm	Loiano	600 m MSL
5	Monari & C.S.S. Farm	Loiano	660 m MSL

The working method envisages a shared participatory approach in order to bring research results and the needs of the chestnut growers closer together: an important step towards a “territorial culture” intended also as greater awareness and regard for the role chestnut growers play in protecting the territory and safeguarding the environment producing high-quality products.

CASTANI-CO has initiated a fruitful exchange between the different participants in the project: growers (S.S Menetti's Terra Amica Farm, Marco Picciati's Teggiolina Farm, Stefano Fogacci's Tizzano Farm, Monari & C.S.S. Farm, and Daniele Canovi's Antico Bosco Farm), consortiums (the Consortium of Chestnut Growers in the Apennines of Bologna, the Consortium of Chestnut Growers in the Apennines of Reggio), associations (the National Association City of the Chestnut Tree) and researchers (I.TER and Bologna University). Meetings have been organized with other Regional, national and European chestnut entities, as well as with public institutions in order to "create a network" to favour, not only co-operation between farms and consortiums but also a wider sharing of the strategies for quality and sustainability of the Regional chestnut sector.

The aims were to:

Quantify the organic matter content and carbon sequestration in the soil of traditional chestnut orchards on the partner farms, in different pedological environments and characterized by different management systems. In each selected chestnut orchard monitoring involved opening designated pedological profiles and analysing specific samples taken with a Dutch auger, in order to estimate the quantity of organic matter present and its variability in space as well as the soil's ability to accumulate carbon in the first 100 cm of soil.

Verify the quality of organic matter by applying indices which provide indications of the soil's ability to store or disperse the organic carbon present. After specific sampling and analyses, the microbial biomass, metabolic quotient (qCO_2), microbial quotient ($qMic$), mineralisation quotient (qM) and biological fertility index (BFI) were evaluated. The latter highlights optimum situations and/or situations of alarm or pre-alarm regarding the supply of organic matter and the possible loss of mineralization

Apply a first approach to estimate the carbon contained in the plants.

Identify and share guidelines to improve management of traditional chestnut orchards to obtain a high-quality product and favour the soil's ability to sequester carbon.

Launch discussions and promote the values of traditional chestnut orchards through a wide publicity campaign involving not only taking part in events, but also producing informative materials, and organizing visits to chestnut orchards with CHESTNUTBUS. All of this has meant reaching a wider audience and favouring a productive and constructive debate between researchers, chestnut growers and Regional officials.

Traditional chestnut orchards and the environment: the important role of the soil and its management

Soil is one of humanity's most precious resources. It is not renewable, and therefore it is necessary to understand, protect and respect it. In nature there is not only one type of soil. Just as rocks, plants and animals differ from one place to another, so does the soil. Diverse types of soil exist, which differ in origin, colour, depth, and fertility. Soil covers the uppermost part of the Earth's surface, and permits plants, animals and humans to live. It is a living, dynamic, productive organism.

To allow sustainable production the soil needs to be healthy; the UN Agency has established that healthy soil is recognized by its "ability to sustain productivity, diversity and the environmental services of the Earth's ecosystems". Therefore, good agricultural practices and agronomic management of the soil play an important role in the production of healthy, nutritious high-quality food. Chestnut cultivation in Emilia-Romagna produces a high-quality fruit which is an interesting example of soil management practices which contribute not only to producing good-quality food, but also to mitigating climate change by encouraging carbon sequestration in the land.

But what does storing, accumulating, sequestering Carbon in the soil mean? They all revolve around simple ecological principles. Through photosynthesis plants "capture" carbon dioxide (CO₂), one of the main greenhouse gases, and accumulate it in their tissues as organic Carbon. The community of soil microbes decompose plant residues which land on the soil. Organic Carbon is stored in the form of complex polymers in the soil, of secondary origin, since they originated from the metabolism of the microbial community, through the process of humification.

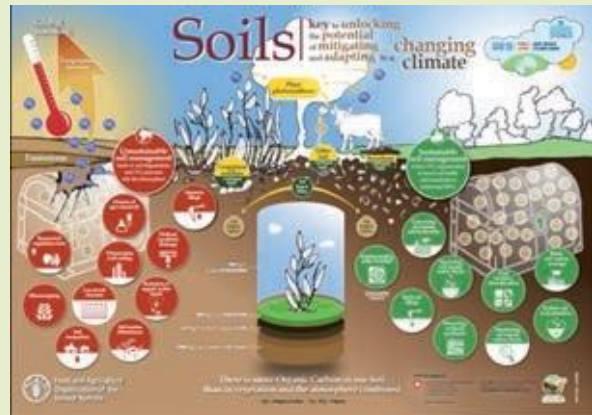


Figure -FAO poster showing how soil constitutes one of the potentialities of mitigating and adapting to climate change

It has been recognised worldwide that “in the first metre of soil on the planet there is more Carbon than in the atmosphere and all the plants on land”. Good practices must sustain the Carbon available for the life of the microbial community so that it can carry out ecological functions and keep the soil healthy.

Considering that carbon sequestration is a medium to long-term process, the loss of organic Carbon from the soil, must be prevented, through the use of sustainable practices, and that increases which result from the adoption of sustainable practices can only be measured years later. The basic process of Carbon sequestration also depends on the “quality” of the organic matter formed during the process of humification.

The formation of stable organo-mineral complexes of the organic matter in the soil, which provide good soil structure, depend on the intrinsic characteristics of the soil (e.g., depth, texture, mineral composition), the characteristics of the site (e.g., morphology, position, aspect and drainage), soil management (e.g., keeping grass coverage, leaving the leaves on the ground, avoiding burning organic materials).

All these factors also influence the speed, the cumulative quantity and the period required to reach maximum capacity of Carbon sequestration in the soil. For this reason, , it is essential to know not only the quantity of organic matter and Carbon present, but also its quality and the metabolic state of the microbial community. Studies and research by CASTANICO have demonstrated that the biofertility index is an excellent indicator to understand the quality of the organic matter and its “stability” to remain in the soil and store Carbon over time.

The results and the discussions initiated in the field have demonstrated that traditional chestnut orchard management practices affect the content and the quality of organic matter and therefore the ability to keep organic Carbon in the soil.

It is therefore essential to appreciate and recognise the important role of chestnut cultivation. It not only produces high-quality produce, but safeguards, preserves and protects the mountain territory promoting the enormous potential of the soil in the struggle against climate change.

Guidelines for best soil management to maintain organic matter and sequester carbon in chestnut cultivation

The definition of “Guidelines for best soil management to maintain organic matter and sequester carbon in traditional chestnut cultivation” is the conclusive objective of the project CASTANI_CO, which aims at promoting and giving value to the role played by chestnut growers in soil management and therefore as custodians of the territory and the mountain environment.

The important information gathered from the Consortiums of chestnut growers in the Region, who have provided advice to their members for a long time, has been correlated with the results obtained from CASTANICO as well as the “Voluntary guidelines for sustainable soil management” (FAO 2015) which clarify the important role sustainable soil management plays in the collective efforts to mitigate and adapt to climate change, fight desertification and protect biodiversity.

Therefore, the guidelines have been defined, using the information available to date, to provide, indications to safeguard the maintenance or improvement of organic matter present in the soil as well as

to preserve and improve the following ecosystem services provided by the soil:

- Support services including primary production, the nutrient cycle and the formation of soil;
- Provision services including supplying food, fibre, fuel, wood and water, primary raw materials, surface stability, habitat and genetic resources;
- Regulatory services concerning the water supply and its quality, carbon sequestration, climate regulation and mitigation of climate change, flood and erosion control;
- Cultural services, indicate aesthetic and cultural benefits derived from the use of the land.

The soil of traditional chestnut orchards is not tilled and therefore the guidelines regard the maintenance of good grass coverage and the best management of naturally available organic material (leaves, spiny cupules, grass cuttings and debris from pruning). The considerations expressed here are based on the results obtained from

the studies carried out by CASTANICO which have highlighted the pedological characteristics of the soils dedicated to chestnut cultivation, the influence of soil management on the content and the quality of organic matter in the first few centimetres of soil and the fragility of the soil if lacking organic matter.

Soil management must therefore be aimed at:

- Maintaining good soil structure to avoid compaction, which would reduce the habitat of the microbial population, reducing the ecological function and biodiversity;
- Reducing wind and water erosion of the soil by maintaining a good level of organic matter, good structural stability and good turnover of organic matter;
- Maintaining sufficient surface coverage to protect the soil encouraging the maximum expansion of natural plant species and leaf litter coverage, especially in wet seasons.
- Maintaining or improving organic matter content, by leaving organic material such as spiny cupoles, leaves and grass cuttings in place;
- Applying good water management techniques which favour the infiltration of rain water and guarantee drainage of excess water, managing water on slopes (agreements between landowners);
- Preserving and protecting the soil to enhance its ability to sequester carbon;
- Reducing the impermeabilization of farm soil to a minimum;
- Not contaminating the soil;

Therefore, it is advisable to:

- Make use of organic material which naturally falls to the ground and is available in a traditional chestnut orchard, trying to reconcile the use of necessary phytosanitary practices with the maintenance of organic matter.
- to facilitate harvesting fruit which has fallen to the ground it is essential to clear the beforehand. It is advisable to remove ferns, branches and other debris and keep them in designated areas in the orchard for compost. However, further in-depth technical and scientific analysis could be useful to evaluate how and when it is best to apply the compost to the soil, to favour degradation of these materials to encourage the accumulation of high-quality organic matter in connection with phytosanitary aspects.
- Avoid burning leaves, spiny cupoles and grass cuttings: the main negative effects of these practices are the reduction of organic matter in the soil, the decrease of biodiversity of the ecosystem, as well as from a health point of view: the loss of populations of *Torymus sinensis*, important antagonist of the chestnut gall wasp. The lack of organic matter from plants in the soil leads to impoverishment of the soil, increasing degradation and exposing it to greater risk of erosion.
- Maintain good plant coverage in the grassy layer in order to both protect the soil from surface water erosion and maintain the organic matter in the first few centimetres of soil.



Operational Group of the European Innovation Partnership for Agricultural Productivity and Sustainability:
CASTANI-CO: Carbon sequestration in the chestnut orchard system

An initiative created within the scope of the Regional Rural Development Programme (RDP) 2014-2020 - Operation Type 16.1.01
Operational Groups of the European Innovation Partnership: "Productivity and Sustainability in Agriculture" - Focus Area 5E



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