Extended Practice Abstract Nº 2

CLIMED-FRUIT

carbocert

Carbocert – Quantification and certification of organic carbon in Mediterranean agricultural soils

Short description of the OG

The general objective of the Carbocert project is to identify management strategies to increase the carbon sequestered and stored in agricultural soils and in the fixed and permanent plant structures of the main Mediterranean crops (olives, citrus, wheat, rice, almonds and vines), as well as to establish methodologies to quantify and certify these removals. This is all in light of the sector's need to adapt to the new climate change scenario characterised by extreme weather conditions in the Mediterranean area.

Benefits

Increasing organic carbon sequestration makes soils more resistant to erosion, increases their water retention capacity, enhances their fertility for plants and helps improve biodiversity.

Additionally, this project provides a methodology to make it possible to certify the carbon sequestration obtained by applying the best practices identified.

Stage of implementation

The Carbocert project was completed in December 2020.

Key Data Box

Theme
Carbon sequestration; climate change adaptation; climate change mitigation; mulching; main Mediterranean crops

Context
The main crops (olives, citrus, wheat, rice, almonds and vines) in the Mediterranean area of Spain.

Application time
All year or seasonal application, depending on each crop.

Required implementation time
Varies depending on crop and practice.

Period of impact
Mid- to long-term, depending on the practice.

Equipment
Equipment needed is dependent on each practice.

Main achieved or expected results

- Specific methodologies were identified for the quantification of carbon sequestration and storage, both in agricultural soils and in the fixed permanent structures of woody crops.
- Best practice guide aimed at farmers to apply the different agricultural management strategies validated by the project.
- A sequestered carbon certification methodology was defined and implemented; it considers the evolution of carbon in the soil and is applicable at both farmer and agricultural holding levels.

Existing materials

Videos

OG presentation:

https://www.youtube.com/watch?v=tpjvQ3MqcfQ_channel=CLIMED-FRUIT

https://www.une.org/SiteAssets/PresentacionGOCARBOCERT

Web links

Project presentation:

https://www.en.une.org/cooperacion/carbocert

https://gocarbocert.es/

Further reading

Carbocert best practice guide:

https://www.une.org/Cooperacin_documentos/GUIA_CARBOCERT.pdf

Contact information

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This extended practice abstract was elaborated in the CLIMED-FRUIT project.

Project website: https://climed-fruit.eu/

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Spontaneous plant cover on almond trees

Challenge

This practice aims to contribute to alleviating one of the major problems resulting from the application of intensive practices in Mediterranean agricultural soils, namely the loss of organic carbon in the soil.

Solution

Implementing plant cover that spontaneously occurs in the alleys, rows or slopes of the plantation to enhance carbon sequestration.

Benefits

Main benefits of this spontaneous cover:

- improves soil structure,
- reduces erosion and runoff,
- increases soil fertility,
- increases water retention,
- reduces the risk of pest and disease attacks,
- helps vegetative control,
- increases crop sustainability,
- facilitates crop tillage.

Applicability box

Theme
Carbon sequestration, climate change and adaptation; erosion control, mulching, nuts (almond)

Context
Almond crops in the Mediterranean area (Spain)

Application time
All year

Required implementation time
Plant cover or its remains should be present throughout the year

Period of impact
3–5 years

Equipment
Cutting implements (mowers, strimmers, brush cutters)

Practical recommendation

Implementation

Spontaneous vegetation cover will be left to grow. Its composition will depend on the type of soil and climate, as well as the previous management of the crop and the surrounding ecosystem.

Vegetation cover on the entire almond plantation is the practice that sequesters the most carbon. It is recommended that the cover is managed using mainly cutting implements (mowers, strimmers, brush cutters) or very superficial tillage, always leaving the plant residues on the surface. The cover could also be removed by thermal (steam, microwave) or chemical systems (although the use of herbicide is discouraged in the context of sustainable and environmentally friendly practices).

For weed control in the row, these same types of management are recommended and could be combined for greater efficiency with mulching, obtained either from mowing the cover itself (Figure 2) or from external inputs (prioritising natural and local mulching). Sheep or goats can also be used for cover control, and this also provides additional nutrients for the soil. This is advisable only during winter dormancy since these animals also graze the lower branches.

Preventing the crop from being affected

The major drawback of using vegetation covers is competition for resources: especially water, but also nutrients. Suitable cover management must make it possible to control the competition to an appropriate extent considering the production objectives.

In this sense, the most efficient covers are those with vegetative cycles that are the opposite of the almond tree cycle (Figure 1), that have living cover between the senescence phase and up to FII and that, if possible, will wither naturally from FIII to post-harvest.

These general indications will vary according to the rainfall each year: in wetter years, the living cover can be extended, while in drier years, earlier management will be necessary. To help ensure the most favourable composition of the spontaneous cover, mowing can be programmed to encourage the natural reseeding of the desired species and prevent undesired species from flowering.

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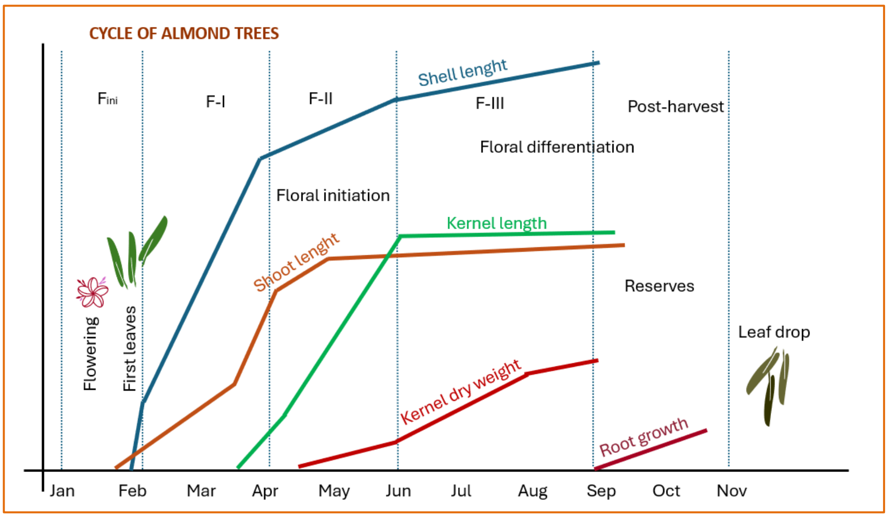

Figure 1. Generic calendar of the phenological cycle of almond trees. Girona, J., 1992. Estrategias de riego deficitario en el cultivo del almendro. *Fruticultura Profesional 47*:38-45. (Photo: IRTA)

Figure 2. Spontaneous dryland cover (left) and spontaneous vegetation cover maintained by mowing (right). (Photos: IRTA)

Further information

Videos

Practice presentation:

https://www.youtube.com/watch?v=tpjvQ3MqcfQ_channel=CLIMED-FRUIT

Web links

Project presentation:

https://www.en.une.org/cooperacion/carbocert

https://gocarbocert.es/

Further reading

Guía de buenas prácticas agrarias Carbocert:

https://www.une.org/Cooperacin_documentos/GUIA_CARBOCERT.pdf

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Simplified cost/benefit analysis

Spontaneous plant cover on almond trees

Introduction – presentation of ex-ante and ex-post situation

Maintaining a spontaneous plant cover on almond plantations year-round has proven to be highly effective in sequestering carbon. It is a key tool for both climate change mitigation and adaptation. In this analysis, the ex-ante situation involves conventional tillage with harrowing, which is the main soil management practice among farmers in the Mediterranean region, where mechanical soil management is conducted three times per year, typically after significant rainfall events. The ex-post situation involves managing a spontaneous plant cover by cutting weeds in May, mainly using cutting implements (e.g. mowers) or very superficial tillage, and by leaving residues on the soil surface.

Economical costs and benefits

This analysis uses data from a 2020 study by Martin-Gorriza et al. (1) that examines two organic rainfed almond orchards located in the Region of Murcia, Southeastern Spain. Production costs do not include fertilizers or pesticides since none were applied (organic almonds). Variable costs include costs related to machinery (fuel and depreciation) and labour.

Legend

Estimated indicator

Measured indicator

	Ex-ante	Ex-post
Variable costs (€/ha)		
Harrowing (3 times per year)	85.01	-
Mowing	-	21.14
TOTAL	85.01	21.14
COMPARISON	Global reduction of 75% of the cost: 	
Sale of almond (€/ha)	2,541.17	614.95
Economic Benefits	There is a 75% reduction in short-term revenue, resulting from a 73% yield decrease of almond kernel: 321 kg/ha (ex-ante) vs 87 kg/ha (ex-post). However, production costs are equally decreased. Long-term benefits include improved soil health, increased future productivity, and significant environment advantages that can translate into economic benefits.	

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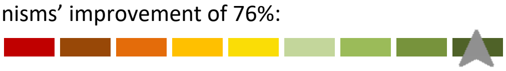
Environmental costs and benefits

Energy	Fuel consumption decrease of 37%: 
Fuel consumption is based on the annual diesel consumption using a 73-kW tractor, which was 35 L/ha-year (ex-ante) and 22 L/ha-year (ex-post). Accordingly, ex-post strategy saved around 37% of diesel fuel. (1)	
Water	Water infiltration improvement of 45%: 
Plant cover boosts water infiltration by up to 45% compared to conventional tillage and reduces evaporation during hot periods. Without vegetation, soil is exposed to sunlight, increasing temperature and water loss, causing desiccation and soil hardening. Plant cover is an effective soil management for maintaining soil moisture, providing better rainwater infiltration, and minimizing surface water loss. (2)	
Soil	OC and N improvement of 56% and 25%, respectively: 
No direct relationship between the practice and the indicator in question	
Air	GHG decrease of 60%: 
Greenhouse gas emissions were 62 kg CO2 eq/ha (ex-ante) and 25 kg CO2 eq/ha (ex-post), which represents a 60% emission reduction with the use of spontaneous plant cover compared to conventional tillage. In both scenarios, soil management was carried out mechanically using diesel tractors and their implements. (1)	
Biodiversity	Organisms' improvement of 76%: 
Though uncommon in Spanish almond plantations, spontaneous plant covers have been shown to enhance biodiversity in crops like vineyards. These covers support natural enemies, and specifically increase the population of Hymenoptera (86%), minute pirate bugs (80%), spiders (40%), mites and thrips (100%). Additionally, cover crops positively influenced the diversity and density of pollinator insects, birds, and small mammals; and have a beneficial effect on bee populations. (6), (7)	

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