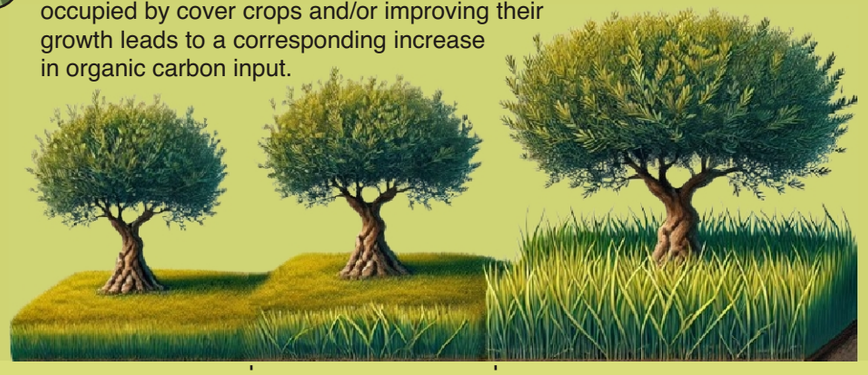
OPTIMIZING THE OLIVE GROVE´S ROLE AS A CARBON SINK

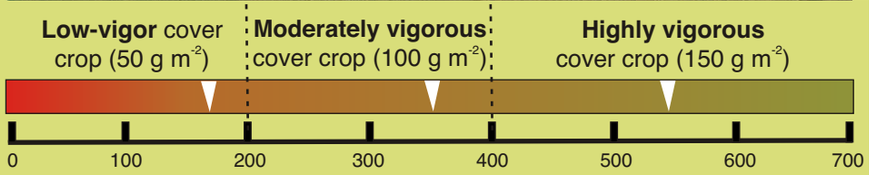
Practical Abstract #4 on the carbon footprint of olive groves

The CARBON FOOTPRINT is calculated by subtracting the annual carbon accumulation (in trees and soil) from the CO_2 and other greenhouse gas (GHG) emissions generated during field operations, such as diesel consumption, fertilization and irrigation. An olive farm can reduce its carbon footprint and enhance its contribution to climate change mitigation in **two ways**:

1. By enhancing organic carbon inputs to the soil

COVER CROPS (spontaneous or seeded) enhance soil organic carbon levels by adding organic matter through their roots and decaying plant material after mowing. This organic matter improves soil structure, promotes microbial activity, and increases carbon sequestration, enriching the soil's carbon content over time. The image below illustrates how expanding the area occupied by cover crops and/or improving their growth leads to a corresponding increase in organic carbon input.

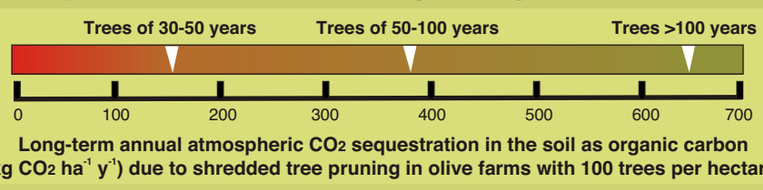




Long-term annual atmospheric CO_2 sequestration in the soil as organic carbon (kg CO_2 ha^{-1} y^{-1}) in olive farms with > 50% ground cover

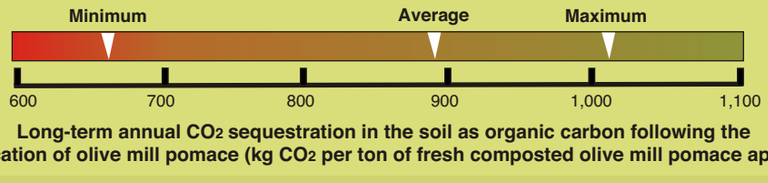
The proportion of the olive grove area covered by cover crops is crucial. If cover crops were allowed to grow on less than 50% of the grove (compared to > 50% as shown in the image) CO_2 sequestration rates would decline to 88, 175, and 265 kg CO_2 per hectare per year for low, moderate, and high vigor covers, respectively.

Shredded pruning remains enriches the soil with carbon, improves its structure, enhances microbial activity, and helps retain moisture, all contributing to a long-term increase in soil organic carbon levels.



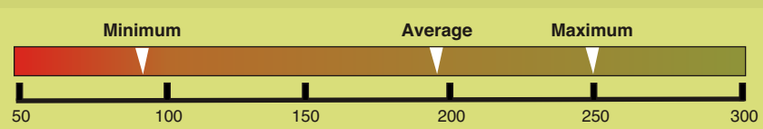
Long-term annual atmospheric CO_2 sequestration in the soil as organic carbon (kg CO_2 ha^{-1} y^{-1}) due to shredded tree pruning in olive farms with 100 trees per hectare.

Composted olive mill pomace is rich in organic matter. When applied to the soil, it decomposes slowly, promoting the formation of humic carbon compounds that help increase the soil organic carbon pool. Over time, this organic input improves soil structure, water retention, and nutrient availability, further supporting carbon sequestration and long-term soil fertility.



Long-term annual CO_2 sequestration in the soil as organic carbon following the application of olive mill pomace (kg CO_2 per ton of fresh composted olive mill pomace applied)

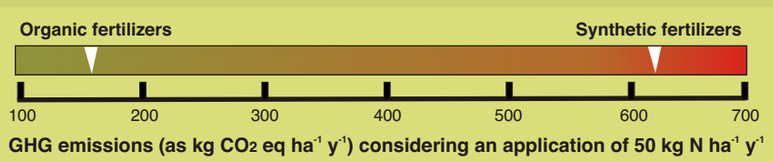
Manure is a valuable source of organic matter that gradually releases organic carbon into the soil, stimulating microbial activity and facilitating the formation of stable humus. This process reinforces carbon sequestration, improves soil structure, and boosts nutrient retention and water-holding capacity, all of which contribute to the long-term soil fertility.



Long-term annual CO_2 sequestration in the soil as organic carbon following the application of manure (kg CO_2 per ton of fresh manure applied)

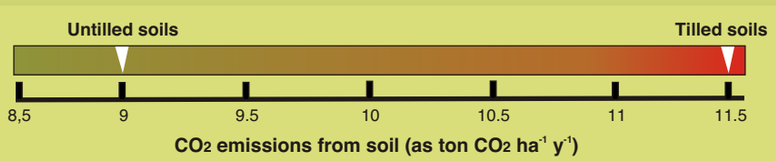
2. By reducing CO_2 emissions from field operations

Replacing synthetic fertilizers with organic alternatives reduces GHG emissions by decreasing the production of energy-intensive inputs, which are major sources of CO_2 emissions. Organic fertilizers release nutrients more gradually, reducing nitrous oxide emissions associated with rapid nitrogen release from synthetic fertilizers. Additionally, organic amendments enhance soil organic matter, promote carbon sequestration, and stimulate microbial activity, further mitigating GHG emissions by improving nutrient cycling and reducing the need for repeated applications.



GHG emissions (as kg CO_2 eq ha^{-1} y^{-1}) considering an application of 50 kg N ha^{-1} y^{-1}

Reducing soil tillage lowers GHG emissions by minimizing soil disturbance, which helps retain soil organic carbon and reduces the release of CO_2 into the atmosphere. Less tillage also decreases fuel consumption from machinery, cutting CO_2 emissions associated with field operations. Additionally, reduced tillage promotes soil microbial activity and improves soil structure, leading to enhanced carbon sequestration and lower nitrous oxide emissions by maintaining better aeration and moisture balance in the soil.



CO_2 emissions from soil (as ton CO_2 ha^{-1} y^{-1})

ABOVE ALL, COMMON SENSE

Recycling organic matter is crucial in the EU's circular economy framework by closing the nutrient loop, reducing dependence on external inputs such as synthetic fertilizers, and fostering a more sustainable agricultural system.

By reusing locally available fertilization sources traditionally seen as waste, including those from their OWN FARMS, olive farmers can not only improve soil fertility but also significantly reduce fertilization costs.

In summary, this approach enhances soil health and promotes more sustainable, cost-effective, and resilient farming practices.

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