

# Science for Environment Policy

## No-tillage management of olive groves can improve soil structure while maintaining yield

**Non-conservative tillage techniques, such as milling and harrowing, are the most common way to manage soil in Mediterranean olive orchards.** A new study confirms the value of alternative methods based on the use of spontaneous cover crops which can significantly improve soil structure and reduce erosion whilst maintaining yields.

**The olive tree is one of the most widespread crops in the Mediterranean basin.** The trees are good at adapting to harsh environmental conditions such as drought and infertile, stony and steep soils. They have therefore historically been grown on marginal lands. [Soil water](#) availability is the major constraint to olive productivity.

Tillage reduces competition to the crops from weeds, helps with the burying of fertilisers and aims to reduce soil water evaporation. However tillage can result in degradation of soil structure and severe soil erosion processes, reducing uptake of water, especially for olive trees on steep slopes. When combined with the high temperature of the Mediterranean, this can also result in high losses of soil organic carbon, a major factor in soil health.

The use of cover crops can improve the ecosystem services delivered by olive orchard systems by reducing many of the negative aspects deriving from tillage. Cover crops can reduce loss of rainwater by runoff, retain the moisture of the soil below and reduce soil erosion. All these have relevance to the European Commission's [cross-compliance](#) concept of keeping land in good agricultural and environmental condition, a precondition for farmers receiving a direct EU subsidy.

The study was carried out from 2007–2009 in a mature olive grove in Southern Italy. Two management systems were put in place. In the 'conventional system' (CS), the surface was tilled two to three times per year, keeping the soils clear of grasses, and trees were heavily pruned every two years, with pruning material removed from the orchard.

In the no-tillage 'sustainable system' (SusS), natural vegetation cover was allowed to accumulate and left on the ground surface after being mowed. The trees were lightly pruned once a year, and the pruning material left on the ground as mulch. Measurements of the impacts on the soil structure, hydraulic conductivity (the ease with which water flows through the soils) and the water content of the soil were taken. The yearly yield of eight trees was recorded for each system.

A clear improvement was found in the SusS management system compared to the CS system. SusS had improved water movement, deeper water infiltration to the soil layers and higher storage capacity of rainwater, especially in autumn–winter. The researchers attribute this to the vegetation cover slowing down the spread of rainwater onto the soil and a better soil structure allowing rain capture both earlier and to deeper soil layers — especially important to olive trees under rainfed conditions.

*Continued on next page.*



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In the CS system, on the other hand, important aspects of soil degradation were detected. The tillage made the soil more vulnerable, breaking apart the bonds between aggregated parts and rearranging particles to form a 'sealed' surface layer of soil, which meant water could less easily infiltrate the surface, resulting in increased surface runoff and soil erosion.

The olive yields were not statistically different between the two systems. They appeared to be most affected by annual rainfall pattern and alternate bearing behaviour (sequential years of higher and lower yields). However, the authors point out the importance of good management of cover vegetation, such as mowing at the right time (early spring) to avoid competition for water with the olive trees during drought-sensitive periods.

The study highlights the environmental benefits of using the spontaneous natural vegetation cover rather than tillage under dry conditions. These include the increase of soil organic carbon, improvement of soil structure and reduction of soil and water losses, all without any loss of yield. The researchers conclude that the well-managed use of spontaneous or seeded cover crops should be strongly recommended by policymakers as an alternative to conventional practices such as tillage.



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