Agroecosystem diversification and sustainable management lead to increased biodiversity, crop production and socio-economic advantages: a case-study of an Italian olive orchard

Adriano Sofo [1], Alba Mininni [1], Carmine Crecchio [2]; Assunta Maria Palese [3], Bartolomeo Dichio [1]

[1] Department of European and Mediterranean Cultures (DiCEM), University of Basilicata, Italy.
[2] Department of Soil, Plant and Food Sciences (DiSSPA), University of Bari, Italy.
[3] Ages s.r.l.s – Academic spin-off.

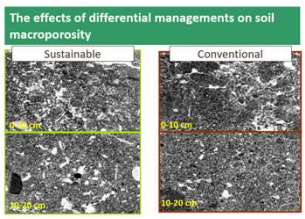
e-mail:adriano.sofo@unibas.it

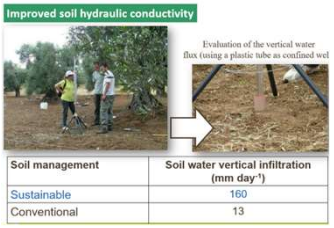
SCENARIO

Climate change, in terms of increased temperature and extreme precipitation regimes, will have agricultural consequences because of the interrelations between climate, land and water use, soil degradation and landscape changes. Sustainable agriculture offers new chances to mitigate these deleterious effects. Sustainable management practices can increase soil carbon (C) inputs, reduce greenhouse gases emissions from the soil and, at the same time, increase agroecosystem biodiversity. This study shows the benefits of sustainable management on biodiversity, crop production and socio-economic aspects in a Mediterranean olive orchard. In 2000, the field was divided into two plots: ***a)* sustainable (S_{mng})** with no-tillage, prunings and spontaneous vegetation used as mulch, irrigation with treated wastewater, correct pruning; ***b)* conventional (C_{mng})** with soil tillage, mineral fertilizers, burning of prunings, empirical irrigation and pruning.

RESULTS

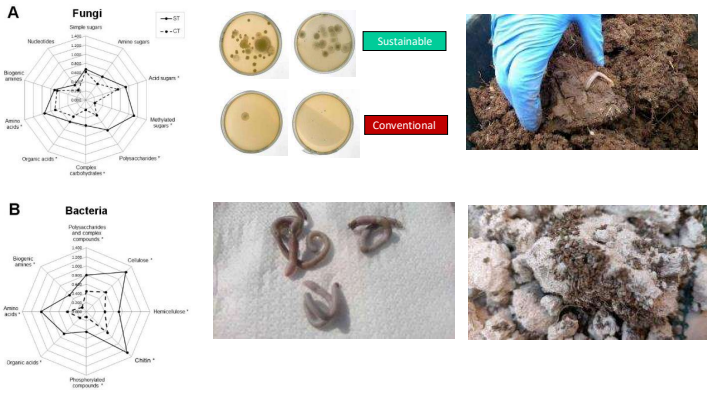
Results show that a 21-year period of S_{mng} caused increases in **soil organic carbon** levels (6.74 vs 11.84 t ha^{-1} in the 0-30 cm soil layer), **soil water retention** (up to 40% more) and soil permeability (from 13 to 160 mm H_2O day^{-1}), so allowing farmers to save irrigation water and improve **soil structure.** The adoption of a correct irrigation management had a key role in the potential role of orchards in C sequestration and on vegetational, and on **soil faunal and microbiological diversity.** Autotrophic microorganisms (both microalgae and cyanobacteria) isolated in the first 5 cm of soil were more abundant and diverse in the S_{mng}, and contribute to soil C and N enrichment.



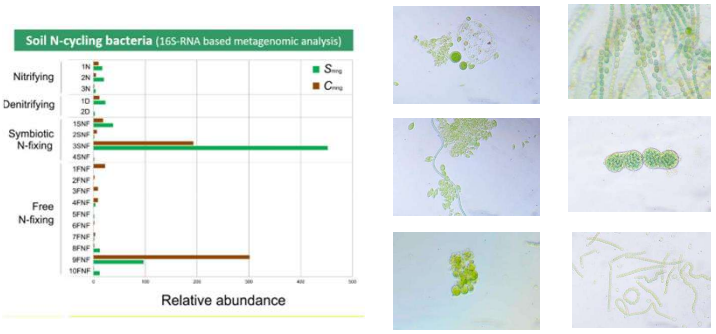


Soil management	Soil water vertical infiltration (mm day^{-1})
Sustainable	160
Conventional	13

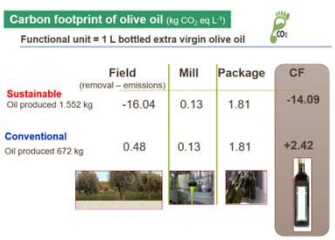
Soil depth (cm)	Baseline SOC stock (t SOC hs^{-1})	Additional SOC storage potential (t SOC ha^{-1} yr^{-1})	SOC stock after 20 years of sustainable management (t SOC ha^{-1})
0-5	7.20 ± 1.49 b	0.61 ± 0.07	19.39 ± 0.13 a
5-10	8.26 ± 1.04 a	0.02 ± 0.04	8.58 ± 0.21 a
10-20	4.76 ± 0.27 b	0.14 ± 0.01	7.56 ± 0.17 a
20-30	5.27 ± 0.64 b	0.09 ± 0.03	7.08 ± 0.08 a
30-50	3.19 ± 1.15 b	0.08 ± 0.04	4.80 ± 0.26 a
60-80	2.94 ± 1.37 a	0.05 ± 0.06	3.95 ± 0.26 a



Compared to dry areas, wetted soils had a higher microbial respiration and SOC mineralization, and a faster bacterial C and N turnover. Finally, the S_{mng} brought benefits on **plant yield,** that was improved (8.4 vs 6.3 t ha^{-1} yr^{-1}). The endogenous C additions had positive effects on the reserves of **soil water and nutrients** (N, P, K, Ca, Mg) and on **CO_2 soil emission.**



Promoting cost-effective sustainable land use strategies aimed and increasing agroecosystem biodiversity can avoid **soil erosion,** compaction and contamination, that are important ecosystem services. The S_{mng} was more effective in terms of productivity and profitability. The **economic analysis** showed that the gross profits of the S_{mng} were considerably higher (6,276 vs 1,517 € ha^{-1}) because of the **higher yield** and its superior quality. Given the importance of the olive growing and the area covered by this crop, the study could be adapted for scaling up for the whole Mediterranean area (9,800,000 ha covered by olive).



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