FARMING PRACTICE
COVER AND CATCH CROPS

IMPACT: CARBON SEQUESTRATION

Reference 15

Payen FT, Sykes A, Aitkenhead M, Alexander P, Moran D, MacLeod M. 2020 Soil organic carbon sequestration rates in vineyard agroecosystems under different soil management practices: A meta-analysis J. Clean. Prod. Elsevier 125736 10.1016/j.jclepro.2020.125736

Background and objective

Understanding and quantifying the mitigation potential of vineyards is important for future policy decisions in the agriculture sector. This paper presents a meta-analysis of the response of SOC stocks in 0–30 cm depth in vineyards to different soil carbon sequestration (SCS) management practices from a global sample of individual field studies. It also compares the changes in SOC stocks depending on climate and study length. Here we report only the results regarding biochar amendment.

Search strategy and selection criteria

A literature search focusing on publications reporting pairwise comparisons between conventional management and SCS practices in vineyards was conducted in October 2019. The search covered the electronic databases of ISI Web of Knowledge and Scopus, using the keywords "soil organic carbon", "soil organic matter" or "soil carbon sequestration" and "vineyard" or "Vitis vinifera". Seeking complete coverage, a second search of the same databases used the keywords "cover crop", "no-tillage", "amendment", "biochar", "hedge", "agroforestry", "pruning", "soil erosion" or "pH" in combination with "vineyard" or "Vitis vinifera". These keywords correspond to SCS practices applicable to viticultural soils, to soil properties playing a role in SOC sequestration, or to phenomena affecting SOC sequestration. Selected studies fulfilled the following criteria: 1) they included experiments measuring SOC or SOM levels within existing vineyards or through experimental manipulation of vineyard management practices; 2) they were performed under field conditions (laboratory studies and pot experiments were excluded) for a minimum period of three years; and 3) they were published in or after 2000. When several studies contained data from the same field experiment, only the longest study was selected to avoid redundancy in the data.

Data and analysis

Bias-corrected 95% confidence intervals were generated for each weighted mean effect size by bootstrapping procedure with 10,000 iterations, using the R package 'boot'.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
50	Vineyards	Cover crops	No cover crop	Metric: Soil organic carbon stocks to a depth of 0.3 m; Effect size: 1) RR = Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control; 2) R= SOC stock relative change rate (RR/time); 3) Relative difference in SOC sequestration rate (in Mg C ha−1 yr−1) between the intervention and the control.	0.9375

Results

- The response ratio was significantly higher than 0 for cover crops.
- Cover crops were associated with a positive SOC stock change rate in time, relative to conventional management. The R averaged 0.058 yr−1 for all practices (cover crops were comparable). This corresponded to an annual SOC stock growth rate of +5.8% yr−1 under SCS management. The highest value (+7.4% yr−1) was observed for the association of organic amendments + no tillage + cover crops.
- Annual SOC sequestration rates under cover crops were around 4 (95%CI: 2 - 6) $MgCO_2$-eq /ha /yr (extracted from figure).
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Cover crops were associated with a positive SOC stock change, SOC change rate in time and annual SOC sequestration rate, relative to conventional management.