

IMPACT: CARBON SEQUESTRATION

Reference 20

Ugarte, CM; Kwon, H; Andrews, SS; Wander, MM. 2014 A meta-analysis of soil organic matter response to soil management practices: An approach to evaluate conservation indicators Journal of soil and water conservation 69, 422-430 10.2489/jswc.69.5.422

Background and objective

Increased understanding of the influences of management practices on soil properties and associated ecosystem function is needed to improve tools used to administer conservation programs in the United States. This study used meta-analysis to assess the influence of cropping systems (conventional, conservation with minimum tillage, conservation with no-till, and organic systems) on soil organic carbon (SOC).

Search strategy and selection criteria

Information about the effects of cropping systems on SOC was collected from peer-reviewed articles published between January of 1990 and January of 2011. Searches were conducted using electronic databases, primarily using the Thomas Reuters Web of Science database (Thomas Reuters, Philadelphia, Pennsylvania) and by reviewing the reference sections of peer-reviewed publications of lead authors known to study soil organic matter in relationship to soil management. Only articles that report results from field-based studies or on-farm research conducted in the continental United States were considered.

Data and analysis

The database was divided according to the depth for SOC reporting (4 categories from 0 to 10 cm to 0 to 30 cm). Unweighted (majority of the studies did not provide information on variability) meta-analysis using MetaWin. The effect sizes were calculated as the ratio between the SOC in ORG and conventional cropping systems. A response ratio greater than one means that management practices used in non conventional cropping systems were able to increase SOC relative to the conventional cropping systems control. Bootstrapping and permutation methods were further used to generate 95% confidence intervals and significance levels of test results. Mean effects, for which confidence intervals did not overlap, were considered significantly different.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
55	Field-based studies and on-farm research conducted in the continental United States assessing the performance of organic systems in comparison to conventional systems.	Organic systems	Conventional systems	Metric: Soil organic carbon content; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	43.75

Results

- The cropping systems' effect in the top three surface depths showed increases in SOC concentrations due to the adoption of alternative cropping systems (organic or conservation or conservation + tillage)
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

The meta-analysis of studies using shallow sampling methods (0 to 20 cm [0 to 7.8 in]) suggested that organic cropping systems are able to increase SOC relative to that found under conventional monocultures with intensive reliance on external inputs.