FARMING PRACTICE
COVER AND CATCH CROPS

IMPACT: CARBON SEQUESTRATION

Reference 1

Crystal-Ornelas, R; Thapa, R; Tully, KL 2021 Soil organic carbon is affected by organic amendments, conservation tillage, and cover cropping in organic farming systems: A meta-analysis Agriculture, Ecosystems & Environment 312, 107356 10.1016/j.agee.2021.107356

Background and objective

The burgeoning primary literature on organic farming now allows direct evaluation of the best management practices (BMPs) within organic farming systems on soil health improvements. The main objective of this meta-analysis was to investigate the effect of BMPs, such as organic amendments, conservation tillage, and cover cropping, on soil health within organic farming systems. We focused on soil organic carbon (SOC).

Search strategy and selection criteria

The authors conducted the systematic search in September 2019 using these search terms. The Thomson Reuters Web of Science (https://www.webofknowledge.com) database produced 1335 potential articles based on their titles, abstracts, and keywords. We then filtered articles provided in English and further excluded articles based on Web of Science's subject matter filter (e.g., filter out articles on "dermatology" or "philosophy"). These exclusions left us with 1230 candidate articles. Next, we searched articles in CABI Abstract databases (https://www.cabi.org) using the same search terms listed above and restricted our search to articles with relevant titles rather than titles, abstracts, and keywords. We located 3387 potential articles in English from the CABI database. Finally, we used two recent systematic reviews on organic farming practices and soil health (Cooper et al., 2016; Tully and McAskill, 2020) to capture any additional articles not found by our systematic search. Published research on organic farming systems (Population): the authors included articles in English that reported soil health metrics (SOC, MBC) in organic farming systems with and without best management practices (BMPs). Articles could be published in any year and any location. We only included organic farming systems that had been organically managed for at least 3 years in alignment with USDA organic farming criteria (USDA, 2019b). Organic farming systems with BMPs (Treatment): Articles had to investigate at least one BMPs (e.g., organic amendments, conservation tillage, cover crops, rotation length and complexity). If an article contained multiple levels of a single BMPs or investigated multiple BMPs, we extracted data for each treatment separately. Organic farming systems without BMPs, i.e. organically-managed control groups (Control): Organically-managed control groups refers to organic systems with the same management except the BMPs under investigation (e.g., no organic amendments, conventional tillage, no cover crops, shortened crop rotation). Measured soil health metrics (Outcome): Articles had to include quantitative measurements for at least one of the following soil health metrics: 1. Soil organic carbon (SOC) concentrations (g kg−1 soil; %C), 2. SOC stocks (kg ha−1), 3. Soil organic matter (g kg−1), 4. Microbial biomass C (µg g−1)

Data and analysis

In all models, we used the inverse-variance method of weighting effect sizes so that more precise measurements (i.e., measurements with lower standard deviation) were given greater weight when calculating an overall effect size (Koricheva et al., 2013). We used a random effects model to calculate an average summary effect of organic farming systems (i.e., pairwise observations evaluating all BMPs pooled together) vs. organically-managed controls on SOC concentrations. First, we fitted a random effects model using topsoil SOC data provided in the articles, then we fitted a random effects model using depth-weighted SOC data. We assigned each article's unique ID code as the random effect to control for multiple SOC data coming from the same article

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
36	Organic farming systems	Organic farming systems using cover crops	Organic farming systems not using cover crops	Metric: Soil organic carbon concentration; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	81.25

Results

- Cover cropping did not show a mean effect different from zero (0.136; CI -0.004/0.277, n=8).
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Organic farming systems cover cropping did not show a mean effect different from zero (+0.136; CI -0.004/0.277, n=8), as compared to organic farming systems not using cover crops.