FARMING PRACTICE
ORGANIC FARMING SYSTEMS

IMPACT: GLOBAL WARMING POTENTIAL (LCA)

Reference 15

Lee K.S., Choe Y.C., Park S.H. 2015 Measuring the environmental effects of organic farming: A meta-analysis of structural variables in empirical research JOURNAL OF ENVIRONMENTAL MANAGEMENT 162, 263-274. 10.1016/j.jenvman.2015.07.021

Background and objective

In recent decades, studies investigating the environmental impacts of organic farming compared to conventional farming have produced conflicting findings. Although some studies have found organic farming to be superior, others have not. The results of environmental assessments of organic farming are difficult to compare because the extant studies have employed different methodologies and measurement procedures. This meta-analysis seeks to identify the structural variables that accounted for differences between studies that found better performance in organic farming systems and studies that did not.

Search strategy and selection criteria

A search of over 100 studies on the environmental effects of organic farming based on the Google Scholar database and the reference lists of previous studies revealed that 45 studies used EE, 40 studies used GHGE, and 22 studies used both EE and GHGE as outcome measures. This body of literature included working papers, research articles and doctoral dissertations published from 1977 through 2012. The final analysis was based on 107 studies published from 1977 through 2012 that compared organic and conventional farming systems using energy efficiency (EE) and/or greenhouse gaz emission (GHGE) as outcome measures, and thus providing 67 EE studies and 62 GHGE studies overall.

Data and analysis

The environmental effect variable served as the dependent variable in the meta-analysis. The environmental performance difference might be positive (i.e., organic farming was superior), neutral (i.e., no difference between organic and conventional farming), or negative (i.e., conventional farming was superior). In this study, the outcome variable was binary with a value of 1 (positive) or 0 (neutral or negative). The logistic regression analysis provided the statistical basis for identifying the structural variables that distinguished between the studies that found beneficial effects for organic farming and those that did not.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
19	Farm-level studies assessing the performance of organic systems in comparison to conventional systems.	Organic livestock and dairy products	Conventional livestock and dairy products	Metric: Greenhouse gas emissions (overall) per unit of product (large majority) and per unit of area (few). GHGE studies more often used output-based outcome measures with LCA as the measurement method. EAM (Energy Analysis Method). In this analysis, the Energy Analysis Method (EAM), Life Cycle Assessment (LCA), Emergy, and other methods, including Life Cycle Climate Impact (LCCI), are compared.; Effect size: Difference of of the considered metrics between intervention and control	43.75

Results

- Livestock products exhibited a negative statistically significant value, which indicated higher Greenhouse gas emissions for organic farming.
- The values for dairy products (p = .534) were positive (fewer GHG emissions for organic farming as compared to conventional), but not statistically significant.
- Although the values for the vegetable and fruit categories were negative, they were not statistically significant.
- Greenhouse gas emissions studies more often used output-based outcome measures with LCA as the measurement method.
- Output-based (ratio/ton) outcome measures significantly reduced the superiority of GHGE effects for organic farming in comparison to area-based (ratio/ha) measures.

Factors influencing effect sizes

- Product/area unit : The logistic regression results indicated that superior GHGE effects for organic farming were highly dependent on the measurement unit. Output-based (ratio/ton) outcome measures significantly reduced the superiority of GHGE effects for organic farming (p = .000) in comparison to area-based (ratio/ha) measures.

Conclusion

Organic livestock products, as compared to conventional, showed significantly higher GHG emissions. Dairy products, fruits, vegetables and crops showed non-significant differences.