

IMPACT: GLOBAL WARMING POTENTIAL (LCA)

Reference 27

Tuomisto HL; Hodge ID; Riordana P; Macdonald DW 2012 Does organic farming reduce environmental impacts? – A meta-analysis of European research Journal of Environmental Management 112, 309-320 10.1016/j.jenvman.2012.08.018

Background and objective

Organic farming is often perceived to have generally beneficial impacts on the environment compared to conventional farming. A meta-analysis was used to evaluate the results of peer-reviewed studies comparing the nutrient losses, biodiversity impacts, greenhouse gas (GHG) emissions, eutrophication potential, acidification potential, energy use and land use in organic and conventional farming systems in Europe. Here, only results on nitrous oxide emissions are reported.

Search strategy and selection criteria

The following search term combinations were used: (organic AND conventional AND farming) OR (organic AND conventional AND agriculture). The preliminary search was refined to the subject areas "agriculture", "plant sciences", "environmental sciences & ecology" and "biodiversity & conservation" 1)the study was related to European farming systems, 2) the study compared organic and conventional farming and provided quantitative results on at least one of the following aspects: soil organic carbon, land use, energy use, GHG emissions, eutrophication potential, acidification potential, nitrogen leaching, phosphorus losses, ammonia emissions or biodiversity, and 3) the paper was published in a scientific peer-reviewed journal. All types of studies (i.e. original field investigations, modelling studies and Life Cycle Assessment studies) were included in the study.

Data and analysis

The median values of the response ratios for each impact category were calculated. The normality of the data was tested by using the Kolmogorov–Smirnov test. Not all impact ratios were normally distributed, therefore a Wilcoxon Signed Rank test was used to determine whether the median impact ratios were significantly different from zero. The correlations between some farming practices and environmental impacts were examined using the Spearman Rank test. SPSS 14.0 software was used for the statistical analyses.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
71	Field studies, modelling studies and Life Cycle Assessment studies assessing the performance of organic systems in comparison to conventional systems in Europe.	Organic production of milk, beef, pork, olives, cereals	Conventional production of milk, beef, pork	Metric: GHG emissions (LCA approach) per unit of product; Effect size: Standardized difference of the considered metrics between organic systems and conventional systems.	68.75

Results

- There were clear differences in the median response ratios between different product groups. Organic olive, beef and some crops had lower GHG emissions whereas organic milk, cereals and pork had higher GHG emissions compared to conventional products.
- In most of cases organic milk production had higher GHG emissions per unit of product, compared with conventional systems, although no statistical test was run (small dataset N=9). Higher GHG emissions in organic systems were due to higher methane and nitrous oxide emissions and lower milk production per animal.
- Organic pork had higher GHG emissions per unit of product, compared to conventional products, although no statistical test was run (small dataset, N=3). GHG emissions from organic pork production were higher, because of high nitrous oxide emissions from straw litter.
- Organic beef had lower GHG emissions per unit of product, although no statistical significance was tested (small dataset, N=4). This was probably due to lower emissions from industrial inputs.
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Aggregated greenhouse gas emissions per unit of product were not significantly different for organic (all production systems) vs conventional systems. For single categories of products, olives, organic milk, beef and pork, results were rated as uncertain, due to the lack of statistical analysis and few data available.