

IMPACT: ACIDIFICATION (LCA)

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Note to the reader: This fiche summarises the effects of Organic farming systems on ACIDIFICATION (LCA). It is based on 2 synthesis papers¹, including 71 and 164 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

The effect of organic farming systems on acidification (as calculated in LCA-modelling studies) is reported in **Table 1**.

The table below shows the number of synthesis papers with statistical tests reporting i) a significant difference between the Intervention and the Comparator, that is to say, a significant statistical effect, which can be positive or negative; or ii) a non-statistically significant difference between the Intervention and the Comparator. In addition, we include, if any, the number of synthesis papers reporting relevant results but without statistical test of the effects. Details on the quality assessment of the synthesis papers can be found in the methodology section of this WIKI.

- per unit of area: no results were available.
- per unit of product: variable effects were reported for organic cropping systems, with 1 synthesis paper reporting non-significant effects and non-statistically tested results for organic cropping systems, in specific product categories (cereals). Negative effects were reported by 1 synthesis paper for organic dairy products, eggs and meats, while another 1 reported non-statistically tested results. Other 2 papers reported non-significant effects for broad categories of organic systems (including different categories of products).

All selected synthesis papers included studies conducted in Europe (see **Table 2**).

Table 1: Summary of effects. Number of synthesis papers reporting positive, negative or non-statistically significant effects on environmental and climate impacts. The number of synthesis papers reporting relevant results but without statistical test of the effects are also provided. When not all the synthesis papers reporting an effect are of high quality, the number of synthesis papers with a quality score of at least 50% is indicated in parentheses. The reference numbers of the synthesis papers reporting each of the effects are provided in **Table 3**. Some synthesis papers may report effects for more than one impact or more than one effect for the same impact.

Impact	Metric	Intervention	Comparator	Statistically tested			Non-statistically tested
				Significantly positive	Significantly negative	Non-significant	
Decrease acidification (lca)	Acidification	Organic cropping systems	Conventional	0	0	1	1
		Organic livestock products	Conventional	0	1	1	1
		Organic systems	Conventional	0	0	2	0

QUALITY OF THE SYNTHESIS PAPERS

The quality of each synthesis paper was assessed based on 16 criteria regarding three main aspects: 1) the literature search strategy and primary studies selection; 2) the statistical analysis conducted; and 3) the evaluation of potential bias. We assessed whether authors addressed and reported these criteria. Then, a quality score was calculated as the percentage of these 16 criteria properly addressed and reported in each synthesis paper. Details on quality criteria can be found in the methodology section of this WIKI.

2. IMPACTS

The main characteristics and results of the 2 synthesis papers are reported in **Table 2** with the terminology used in those papers, while **Table 3** shows the reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**. Comprehensive information about the results reported in each synthesis paper, in particular about the modulation of effects by factors related to soil, climate and management practices, are provided in the **summaries of the synthesis papers** available in this WIKI.

Table 2: Main characteristics of the synthesis papers reporting effects on Acidification (LCA). The references are ordered chronologically with the most recent publication date first.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
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¹ Synthesis research papers include either meta-analysis or systematic reviews with quantitative results. Details can be found in the methodology section of the WIKI.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref11	LCA studies assessing the performance of organic systems in comparison to conventional systems. Emissions are accounted for all 'cradle-to-farm gate' activities.	Global. The majority of LCA publications included in these analyses are from agricultural systems in Europe, North America, and Australia and New Zealand (86% of systems are from these regions). Systems from China (2%), Japan (2%), the rest of Asia (5%), South America (4%), and Africa (4%) are much less common.	164	Organic Cereals, Organic pulses and oil crops, Organic fruits, Organic Vegetables, Organic meats, Organic dairy products and eggs	Conventional systems	Acidification potentials per unit of product. Acidification potential is reported in SO ₂ equivalents and includes acidification potential from sulfur dioxide, nitrogen oxides, nitrous oxide, and ammonia, among others.	Organic systems (cereals, oil crops and pulses, fruits, vegetables, meats) show similar acidification potential as conventional systems, per unit of product. Organic dairy products and eggs show higher acidification potential per unit of product.	62%
Ref27	Field studies, modelling studies and Life Cycle Assessment studies assessing the performance of organic systems in comparison to conventional systems in Europe.	Europe	71	Organic production of milk, cereals, beef, pork	Conventional systems	Acidification potential per unit of product (LCA approach)	The median response ratio for acidification potential was 0.147 (increase of 14.7%, with respect to conventional systems). However, the difference is not statistically significant. When different products were compared, it was found that organic livestock products and cereals had higher acidification potential, whereas some organic crop products had lower acidification potential than conventional products.	69%

Table 3: Reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**.

Impact	Metric	Intervention	Comparator	Statistically tested			Non-statistically tested
				Significantly positive	Significantly negative	Non-significant	
Decrease acidification (Ica)	Acidification	Organic cropping systems	Conventional			Ref11	Ref27
		Organic livestock products	Conventional		Ref11	Ref11	Ref27
		Organic systems	Conventional			Ref11 and Ref27	

3. FACTORS INFLUENCING THE EFFECTS ON ACIDIFICATION (LCA)

No factors were found.

4. KNOWLEDGE GAPS

The authors did not report knowledge gaps in the reviewed synthesis papers.

5. SYNTHESIS PAPERS INCLUDED IN THE REVIEW

Table 6: List of synthesis papers included in this review. More details can be found in the summaries of the meta-analyses.

Ref Num	Author(s)	Year	Title	Journal	DOI
Ref11	Clark, M; Tilman, D.	2017	Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice.	ENVIRONMENTAL RESEARCH LETTERS 12 6	10.1088/1748-9326/aa6cd5
Ref27	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

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