SINGLE-IMPACT FICHE
ORGANIC FARMING SYSTEMS

IMPACT: EUTROPHICATION (LCA)

Data extracted in October 2021
Fiche created in March 2024

Note to the reader: This fiche summarises the effects of Organic farming systems on EUTROPHICATION (LCA). It is based on 2 synthesis papers[1], including 71 and 164 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

The effect of organic farming systems on Eutrophication potential (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.

- Eutrophication potential per unit of product: for both organic cropping systems and organic livestock products, 1 synthesis papers reported non-significant effect and 1 negative effect.
- Non-statistically tested results were reported by 1 synthesis paper for specific categories of products (e.g. cereals, dairy products, meats, eggs), due to lack of sufficient data.
- Eutrophication potential per unit of area: no results were available.

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.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease eutrophication (lca)	Eutrophication potential per unit of product	Organic cropping systems	Conventional	0	1	1	1
		Organic livestock products	Conventional	0	1	1	1
		Organic systems	Conventional	0	0	1	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 Eutrophication (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
Ref11	LCA studies assessing	Global. The majority of LCA	164	Organic Cereals,	Conventional	Eutrophication potential per unit of	Organic systems (all systems. as average)	62%

[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
	the performance of organic systems in comparison to conventional systems. Emissions are accounted for all 'cradle-to-farm gate' activities.	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.		Organic pulses and oil crops, Organic fruits, Organic Vegetables, Organic meats, Organic dairy products and eggs	systems	product (a measure of nutrification) is reported in PO_4 equivalents and includes eutrophication potential from phosphate, nitrogen oxides, ammonia, and ammonium, among others. Eutrophication is a measurement of the increase in nutrients entering an ecosystem. Eutrophication has substantial environmental impacts including, but not limited to, algal blooms and aquatic dead zones. Emissions are accounted for all 'cradle-to-farm gate' activities.	37% higher (p = .0383; n = 20) eutrophication potential per unit of product than conventional systems. For organic cereals, vegetables and meats eutrophication potentials per unit product resulted significantly higher, as compared to conventional products. For organic pulses, oil crops, dairy products and eggs, eutrophication potentials per unit product resulted in no significant change, as compared to conventional products.	
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	Eutrophication potential per unit of product (LCA approach)	There is not a single organic or conventional farming system, but a range of different systems, and thus, the level of many environmental impacts depend more on farmers' management choices than on the general farming systems.	69%

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

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease eutrophication (lca)	Eutrophication potential per unit of product	Organic cropping systems	Conventional		Ref11	Ref11	Ref27
		Organic livestock products	Conventional		Ref11	Ref11	Ref27
		Organic systems	Conventional			Ref27	

3. FACTORS INFLUENCING THE EFFECTS ON EUTROPHICATION (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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