SINGLE-IMPACT FICHE – ORGANIC SYSTEMS

IMPACT: Greenhouse gas emission

Data extracted in September 2020

Note to the reader: This fiche summarises the impact of organic systems on GREENHOUSE GAS EMISSION. It is based on 5 peer-reviewed synthesis research papers[1]. Each synthesis paper includes a number of individual studies, which ranges in this case from 7 to 164.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT: When emissions were expressed per unit of area, two synthesis papers[1] reported a positive effect of organic systems (a decrease of greenhouse gas emissions) compared to conventional systems, while one showed no effect (see **Table 1**). However, when greenhouse gas emissions were expressed per unit of product -and not per unit of area-, two synthesis papers reported a negative effect, one a positive effect (but with a quality score lower than 50%), and two reported no effect. The differences between results obtained per unit area and per unit of product are due to the lower yields obtained in organic systems compared to conventional systems. All syntheses included studies conducted in Europe.

Table 1. Summary of impacts. The effect with the higher score is marked in bold and the cell coloured. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be found in the next section.

	Effects per unit of area (e.g., per ha)					Effects per unit of product (e.g., per ton)			
Impact	**Positive**	**Negative**	**No effect**	**Uncertain**		**Positive**	**Negative**	**No effect**	**Uncertain**
Decrease of greenhouse gas emission	**1**	0	2	1 (0)		0	**1**	**3**	1 (0)

- QUALITY OF THE SYNTHESIS PAPERS: [The quality score summarises 16 criteria assessing the quality of three main aspects of the synthesis papers: 1) the literature search strategy and studies selection; 2) the statistical analysis; 3) the potential bias. Details on quality criteria can be found in this document →]

  As shown in the "Quality score" of the table in section 2, the quality level ranges from 44% to 69%. The least frequently satisfied quality criteria were "Search string", "Dataset available", "Method of data extraction", "Heterogeneity of the results analysed", and "Publication bias analysed" (the latter is never satisfied).

[1] Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results

2. IMPACTS

The main characteristics and results of the 5 synthesis papers are summarized in **Table 2**. The references are ordered chronologically with the most recent publication date first.

Table 2. Main characteristics of the synthesis papers reporting impacts on GHG emissions. All detailed results of each synthesis study are reported in the summary reports  .

Nr	Reference	Population	Geographical scale	Intervention	Comparator	Conclusion	Quality score	Global effect
1	Clark, M; Tilman, D. 2017	Organic and conventional agricultural production systems.	Global*	Organic systems	Conventional systems	Organic systems show similar greenhouse gas emissions as conventional systems.	62%	Per unit of product: No effect
2	Lee K.S., Choe Y.C., Park S.H. 2015	Organic and conventional systems	Global	Organic systems	Conventional systems	In terms of greenhouse gas emissions, organic farming was favored over conventional farming. The meta-analysis results confirmed the results of earlier meta-analyses that found superior environmental effects for organic farming per unit of land, rather than per unit of output.	44%	Uncertain (per unit of area and per unit of product)
3	Skinner, C; Gattinger, A; Muller, A; Mader, P; Fliessbach, A; Stolze, M; Ruser, R; Niggli, U. 2014	Arable, grassland, rice-paddies lands in organic and in non-organic agriculture	Global**	Organic systems	Conventional systems	There is scientific evidence for lower nitrous oxide emissions from organically managed soils when scaled to the area of cultivated land but higher emissions when crop yield-scaled. This discrepancy is due to the observed 26% lower crop yield under organic management.	50%	Per unit of field area: Positive; Per unit of product: Negative.
4	Tuomisto HL; Hodge ID; Riordana P; Macdonald DW. 2012	Organic and conventional systems	Europe	Organic systems	Conventional systems	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%	Per unit of field area: Positive; Per unit of product: no effect.

Nr	Reference	Population	Geographical scale	Intervention	Comparator	Conclusion	Quality score	Global effect
5	Mondelaers, K; Aertsens, J; Van Huylenbroeck, G. 2009	Organic and conventional systems	Global	Organic systems	Conventional systems	Organic farming seems to score equal or better when emissions are expressed per unit area. Per unit of product no general direction is noticeable.	50%	No effect either per unit of area or per unit of product

*In Clark and Tilman (2017), the majority of LCA publications included 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. The results presented here are therefore indicative of highly industrialized systems and should be interpreted with this in mind.

**In Skinner et al. (2014), only one comparative study on rice paddies is considered. all 19 retrieved studies were conducted in the northern hemisphere under temperate climate.

3. KNOWLEDGE GAPS

The synthesis papers did not indicate relevant knowledge gaps.

4. SYSTEMATIC REVIEW SEARCH STRATEGY

Keywords	TOPIC: ("organic farm*" OR "organic agriculture" OR "organic system*" OR "organic product*") AND TOPIC: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")
Search dates	No time restrictions
Databases	Web of Science and Scopus, run on 20 July 2020
Selection criteria	Three main criteria led to the exclusion of a synthesis paper: (1) the paper does not deal with organic systems; (2) the paper does not assess the impacts of organic systems in comparison to another cropping system; (3) the paper is neither a meta-analysis nor a systematic review. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on paper by paper basis. From an initial number of 122 synthesis papers, we finally selected 5 meta-analyses or systematic reviews.