SINGLE-IMPACT FICHE
ORGANIC FARMING SYSTEMS

IMPACT: ENERGY USE

Data extracted in October 2021

Note to the reader: This fiche summarises the impact of organic systems on ENERGY USE. It is based on 3 peer-reviewed synthesis research papers[1], including 71, 62 and 164 studies, respectively.

1.WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT: The effect on ENERGY USE of organic farming systems, as compared to conventional systems, are reported as:
  - per unit of area: no results were available.
  - per unit of product: results strongly differ, according to the type of product. The majority of results showed positive effects (i.e. lower energy use), in the case of cereals, oils and pulses and dairy products in two synthesis papers and an overall positive effect was shown for cropping systems as average, by another synthesis paper. No significant effects were also found for crops (all types as average), fruits, livestock and dairy products, meats and for all systems (as average). Negative effects (i.e. higher energy use) were found for organic vegetables production by one synthesis paper and for vegetables and fruits (as average) by another synthesis paper.

All the synthesis papers[1] included results of experiments conducted in Europe.

Table 1. Summary of effects of energy use. The numbers between parentheses 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. Some synthesis papers reported effects for more than type of system.

Impact	Metric	Impacts per unit of agricultural land				Impacts per unit of product			
		Positive	Negative	No effect	Uncertain	Positive	Negative	No effect	Uncertain
Organic cropping systems									
Decrease Energy use						3 (3)	2 (1)	2 (1)	1 (1)
Organic livestock systems									
Decrease Energy use						1 (1)	0	2 (1)	1 (1)

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 the methodology section of this WIKI.*

2. IMPACTS

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

The main characteristics and results of the 3 synthesis papers[1] are summarized in **Table 2**. Summaries of the meta-analyses provide fuller 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.

Table 2. Main characteristics of the synthesis papers reporting impacts on energy use.

Reference	Population	Geographical scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Clark, M; Tilman, D. 2017	LCA studies assessing the performance of organic systems in comparison to conventional systems. Emissions are accounted for all 'cradle-to-farm gate' activities.	Global*	164	Organic Cereals, Organic pulses and oil crops, Organic fruits, Organic Vegetables, Organic meats, Organic dairy products and eggs	Conventional systems	Energy use per unit of product	Organic systems use 15% less ($p = .0452$; $n = 33$) energy per unit of product, than conventional systems. Significantly lower energy use for dairy products, cereals, oil crops and pulses. Significantly higher energy use for vegetables. No significant effect for meats and fruits.	62%
Lee K.S., Choe Y.C., Park S.H. 2015	Farm-level studies assessing the performance of organic systems in comparison to conventional systems.	Global	62	Organic systems	Conventional systems	Energy use efficiency. In this analysis, the Energy Analysis Method (EAM), Life Cycle Assessment (LCA), Emergy, and other methods, including Life Cycle Climate Impact (LCCI), are compared.	Significantly lower energy efficiency for organic fruits and vegetables. Although the values for the dairy, livestock, and mixed crop categories were positive, they were not statistically significant.	44%
Tuomisto HL; Hodge ID; Riordana P; Macdonald DW 2012	Field studies, modelling studies and Life Cycle Assessment studies of organic systems in comparison to conventional systems in Europe.	Europe	71	Organic production of olives, milk, cereals, beef, pork, ley	Conventional systems	Energy use per unit of product (LCA approach)	This meta-analysis has shown that organic farming in Europe has generally lower energy consumption than conventional farming.	69%

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

3. KNOWLEDGE GAPS

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