

# SINGLE-IMPACT FICHE – ORGANIC SYSTEMS

## IMPACT: PEST AND DISEASE CONTROL

Data extracted in October 2021

**Note to the reader:** This fiche summarises the impact of organic systems on PEST AND DISEASE CONTROL (namely: 1) natural enemies of pests abundance and 2) pests/diseases abundance). It is based on 2 peer-reviewed synthesis research papers<sup>1</sup>, including 71 and 134 studies, respectively.

### 1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:** compared to conventional systems, the 2 synthesis papers<sup>1</sup> reported a positive effect of organic cropping systems on abundance of natural enemies (i.e. increased abundance of natural enemies), and a negative effect on pest and disease abundance (i.e. an increased incidence and/or severity level of pests and diseases). See these effects in the **Table 1**. All results are expressed per unit of area (e.g., per ha). Thus, although abundance of natural enemies was increased in organic systems, the disease and pest pressures were higher in organic systems than in conventional systems. No results were reported per unit of product. All the synthesis papers<sup>1</sup> included results of experiments conducted in Europe.

**Table 1.** Summary of effects. The effect with the higher score is marked in bold and the cell coloured. 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 *
<b>Organic cropping systems</b>									
Increase Pest and disease control	Natural enemies of pests	<b>2 (2)</b>	0	0	0				
	Pests per unit of area	0	<b>2 (2)</b>	0	0				

\* Number of synthesis papers that report relevant results but without statistical test comparison of the intervention and the control.

- 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" in **Table 2**, the quality the 2 synthesis papers retrieved ranged from 56% to 94%. The least frequently satisfied quality criteria were: "Search string", "Number of studies of each step", "Individual effect sizes", "Individual studies weighted", "Heterogeneity of results analysed" and "Publication bias analysed".

### 2. IMPACTS

<sup>1</sup> Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results

The main characteristics and results of the 2 synthesis papers<sup>1</sup> 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 pest and disease control. All detailed results of each synthesis study are reported in the summary reports [→](#).

Reference	Population	Geographical scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Garratt, MPD; Wright, DJ; Leather, SR. 2011	Studies assessing the performance of organic systems in comparison to conventional systems.	Global	71	Organic systems	Conventional systems	Abundance, fecundity, development rate, size and damage. Pests and natural enemies of pests.	Pest responses suggest that controlling pests in organic systems may be a limitation. Nonetheless, natural enemy abundance is higher in organic systems than in conventional systems	56%
Muneret, L; Mitchell, M; Seufert, V; Aviron, S; Djoudi, E; Petillon, J; Plantegenest, M; Thiery, D; Rusch, A. 2018	Studies assessing the performance of organic systems in comparison to conventional systems.	Global	134	Organic cropping systems	conventional cropping systems	Biological control potential (predation rate, parasitism rate and soil-suppressiveness, that is, soil ability to suppress pathogens following their inoculation); 2) pest infestation (disease severity or incidence, pest abundance or pest density, weed soil cover, weed biomass or weed density)	Results show that, compared to conventional cropping systems, 1) organic farming promotes overall biological pest control potential, 2) organic farming has higher levels of overall pest infestations but 3) this effect strongly depends on the pest type. The meta analyses show that there are lower levels of pathogen infestation, similar levels of animal pest infestation and much higher levels of weed infestation in organic than in conventional systems.	94%

### 3. KNOWLEDGE GAPS

<b>Garratt et al., 2011</b>	This review also serves to highlight the potential importance that fertilisers play within a farming context in determining pest and natural enemy populations, although it does emphasise a gap in the research, predominantly with regards to natural enemies and the impact of organic and conventional fertilisers.
<b>Muneret et al., 2018</b>	There is a need for more studies about the effect of landscape composition (especially considering organic farming in the landscape) on pest infestation levels.

### 4. SYSTEMATIC REVIEW SEARCH STRATEGY

<b>Keywords</b>	<p>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")</p> <p>TOPIC: ((organic near/4 farm*) OR (organic near/4 agric*) OR (organic near/4 produc*) OR (organic near/3 livestock) OR (organic near/3 animal)) AND TOPIC: ("animal*" OR "livestock" OR "ruminant*" OR "small ruminant*" OR "cattle" OR "dairy cattle" OR "dairy" OR "beef cattle" OR "sheep" OR "ewe*" OR "lamb*" OR "swine" OR "pig*" OR "porcine*")</p>
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	OR "goat*" OR "rabbit*" OR "poultry" OR "chicken*" OR "broiler*" OR "turkey*" OR "hen*" OR "horse*" OR "mule*" OR "milk" OR "egg" OR "beef" OR "cheese" OR "meat" OR (animal near/2 protein*) OR "yogurt" OR "bacon" OR "pork") 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 for the first time in July 2020 and updated in September 2021 and October 2021.
Selection criteria	Four 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 report results on the effect of specific farming practices (e.g. organic fertilisation, green manure, alternative pest control techniques, etc.) which are part of organic systems, instead of the effect of the whole farming system; (4) the paper is neither a meta-analysis nor a systematic review including quantitative results. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on paper-by-paper basis. From the 220 potentially relevant synthesis papers, 140 were excluded after reading the title and abstract, and 50 after reading the full text according to the above-mentioned criteria. Finally, 30 synthesis papers were selected for organic farming systems, from which 2 were relevant for this impact.