GENERAL FICHE – ORGANIC SYSTEMS

Data extracted in September 2020

Note to the reader: This *general fiche* summarises all the environmental and climate impacts of organic systems found in a review of 28 synthesis research papers[1]. The general fiche provides the highest level of synthesis – symbolised by the top of the pyramid -. As each synthesis research paper involves a number of individual papers ranging from 7 to 164 (often about 50), the assessment of impacts relies on a large number of results obtained mainly in field experiments (carried out in situations close to real farming environment), and sometimes in lab experiments or from model simulations. In addition to this general fiche, *single-impact fiches* provide a deeper insight in each individual impact of organic systems (e.g. on carbon sequestration, on biodiversity, etc.), with more detailed information – medium part of the pyramid -. Finally, *individual reports* 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 – base of the pyramid .

This general fiche on organic systems is part of a set of similar fiches providing a comprehensive picture of the impacts of farming practices on climate and environment.

1. DESCRIPTION OF THE FARMING PRACTICE

Description	According to IFOAM (2008)[2], organic agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved.
Key descriptors	• Organic farming system is a production system which avoids or largely **excludes** the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives (Litterick and Watson, 2003)[3]. • To the maximum extent feasible, organic farming systems **rely on** crop rotations, crop residues, animal manures, green manures, off-farm organic wastes and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weeds and other pests (Litterick and Watson, 2003)[3].

[1] Synthesis research papers include either meta-analysis or systematic reviews with quantitative results.
[2] https://archive.ifoam.bio/sites/default/files/page/files/doa_french.pdf
[3] https://doi.org/10.1016/B0-12-227050-9/00235-0 and https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/organic-farming-system

2. DESCRIPTION OF THE IMPACTS OF THE FARMING PRACTICE ON ENVIRONMENT AND CLIMATE

We compare the impacts of organic and conventional farming systems. Conventional systems are commonly used in the regions where the experiments are located and rely on the use of chemical inputs, such as chemical fertilizers and pesticides. In the synthesis papers[1] reviewed, the effects of organic systems were expressed either per unit of cultivated area (e.g., per ha) or per unit of product (e.g., per kg of grain). Since organic systems generally result in lower yields than conventional systems, the impacts per unit of product may be sometimes opposite to those per unit of area. Consequently, where available, both types of results are reported in the summary table below.

For each impact, the effect with the higher score is marked in bold and the cell coloured. Almost all of the synthesis papers[1] reviewed included experiments conducted in Europe. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%; when there is no number between parenthesis, it means that all the papers have a quality score higher than 50%.

	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 nutrient loss	**2**	0	1	0		0	**1**	**1**	0
Increase carbon sequestration	**8 (6)**	0	1*	0		0	0	0	0
Decrease eutrophication	**1**	0	0	0		0	**1**	**1**	0
Decrease acidification	0	0	0	0		0	0	**2**	0
Decrease greenhouse gas emissions	**1**	0	**2**	1 (0)		0	1	**3**	1 (0)
Improved pest and disease control: Increase abundance of natural enemies	**2**	0	0	0		0	0	0	0
Improved pest and disease control: Reduction of pests and diseases	0	**2**	0	0		0	0	0	0
Increase biodiversity	**11 (10)**	0	0	2		0	0	0	0
Increase yield	0	**9+2***	1*	0		-	-	-	-
Decrease of agricultural land use	-	-	-	-		0	**2**	0	0
Decrease energy use	**1 (0)**	0	0	0		**3 (2)**	1	1	0

* The value shows the effect on variability rather than the usual average value. The objective is to check if yield (or another outcome) is more variable in organic systems than in conventional systems.

3. DESCRIPTION OF THE KEY FACTORS INFLUENCING THE SIZE OF THE EFFECT

Only the factors explicitly studied in the reviewed synthesis papers are reported below. Details regarding the factors can be found in the *individual reports* following the hyperlinks (→ or refX).

IMPACTS	FACTORS
Decrease nutrient loss →	Nitrogen input (ref1).
Increase carbon sequestration →	Plough depth; input of stable organic matter by means of organic manure and soil improvers; crop residues incorporation during ploughing; conversion of grassland into arable land; manure application rules; mineralization rate due to climate change (ref1); Differences in external C inputs, clay concentrations, mean annual precipitation, and mean annual temperature did influence differences in SOC concentrations and stocks (ref2); Input of organic matter, presence of leys in the rotation (ref3); C input, soil disturbance (ref4); Fertilization intensity and climate (ref 7); Region (or certification guidelines) and type of crop (ref8).
Reduction of eutrophication →	Quantity and type of fertilizer (ref1)
Reduction of greenhouse gas emissions →	Quantity and type of fertilizer (ref1); Type of product (ref2); Crop rotation, total N inputs (for emissions from conventionally managed soils), concentration of soil N and soil organic carbon, soil texture (clay contents) (ref 3, ref 4).
Increase pest- and disease- control →	Pest type (ref 1, ref 2); Crop type (ref 1, ref 2); Type of experiments (station vs. on farm) (ref 2)
Increase biodiversity →	Field size (ref1); pest management strategy, cover crop, compost (ref3); crop rotation, type of crop, organic input (ref5); proportion of arable land in the landscape, organism group (ref7); scale (ref8); taxa (ref11); landscape (ref13).
Increase yield →	Amount of N input (ref1); Rotation (ref4); Use of green manure and enhanced fertilisation (ref6); Field size (ref10).
Reduction of energy use →	Amount and type of N fertilizer (ref1); Type of product, measurement unit (ref2).

4. PREVIOUS IMPLEMENTATION

GAEC Cross compliance	
Greening	
Rural development measure – submeasure	

5. PICTURES

Pictures are not relevant in this case.

6. LINKS TO OTHER RELEVANT COMPLEMENTARY INFORMATION

We include in this section the links to other complementary sources of information (not peer-reviewed meta-analyses or systematic reviews), provided by AGRI or other stakeholders.