Meta-analysis literature review on farming practices
Launching a wiki website for Member States

GREXE meeting, 27 April 2021

Access the wiki

https://webgate.ec.europa.eu/fpfis/wikis/display/IMAP/Home

Accessibility to the wiki need to be granted, steps to follow:

1. **Each user needs to have a EU login**
   - To create one please visit the website: https://ecas.ec.europa.eu/cas/manuals/EU_Login_Tutorial.pdf
2. **Each user needs to be accredited by the JRC**
   - Please nominate a coordinator for your country that manages users access requests and questions
   - The coordinator will send the list of persons (email address) to be accredited to access the wiki.
   - The coordinator will exchange about the wiki through functional mail box JRC-wiki-CAP-SP@ec.europa.eu

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Use of the functional mail box
(related to the JRC wiki CAP SP tool)

- Technical or project related questions and content questions will be addressed
- Please write to the functional email address: JRC-wiki-CAP-SP@ec.europa.eu
- Communication through the coordinator only (to streamline exchanges)

Targeted audience

Colleagues in MS administrations working on CAP strategic plans environmental issues: objectives 4 climate change – 5 natural resources – 6 biodiversity – 9 food and health

- Overall strategy and green architecture
- Intervention logic
- Definitions
- Conditionality
- Interventions:
  - link to objectives – result indicators and targets,
  - intervention design with particular reference to requirements, eligibility conditions, baseline

iMAP4Agri – the extension

- iMAP4Agri is an administrative arrangement between DG AGRI and JRC
- Traditional activities in previous years: modelling, outlook estimations / conferences, studies
- Additional budget to support **CAP plans assessment and management on environment and climate objectives**
- Until end 2021 (but activities could continue afterwards)

Description of the activity

Objectives

- Clarify intervention logic, expected impact, causal links and quantification between **environmental and climate farming practices (FP)** and CAP objectives
- **Gather information available** on environment and climate issues (e.g. as in water knowledge hub https://water.jrc.ec.europa.eu/)
- Improve or develop **indicators methodologies** for modelling, impact assessment, monitoring and evaluations

Tasks

- **Scientific literature review**:
  - Matrix with impacts FP - objectives
  - Fiches with meta analysis results
  - Typologies of FP
  - Result – impact indicators methodologies
- **Inventory** of data, indicators and legislation
- **Development of new indicators** (e.g. I.20 Landscape features – I.9 Resilience) and **methodology** (avoid double counting of areas for output and result indicators)

Users

- DG AGRI and other DGs units/colleagues working on environmental issues
- Desk officers – geo hubs which will assess CAP plans
- Member Stattes colleagues working on CAP plans
- External users such as evaluators, researchers etc.

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Classification / typology of farming practices

Current issue

- Limited possibility to identify and report on targeted information on farming practices financed in the CAP (e.g. not enough disaggregation)
- Lack of a standardised system of classification of practices and their link to CAP objectives

How to improve the situation in the next period

- Literature review on all farming practices
- Work on recognised /common definitions
- Define a clear list of practices suitable for the whole CAP (conditionality – ecoschemes – management commitments – non productive investments etc.)

Classification / typology of farming practices

How to report on farming practices

- Apply the standardised classification to CAP plan interventions
- The attribution will be done **by DG AGRI after the CAP plans approval**
- Reports: extract farming practices across different MS and different interventions to answer the following questions
  - In how many CAP plans a practice is applied
  - Uptake in terms of areas and financial allocation
  - Use of the above information: in evaluations and models

Practical management still to be defined

- How to classify interventions with more than one practice (e.g. organic + crop rotation)
- Consolidated list of typologies to be applied for the purpose of reporting,
  - for example, how to classify «no or reduced use of pesticides»
    - Demarcation with organic
    - Inclusion of integrated pest management (from legislation) and integrated production (as most common practice used in some MS)

Farming practices fiches: why they are relevant for you

M Pérez-Soba, A Schievano, JM Terres (JRC-D5)

D Makowski (INRAE)

GREXE meeting, 27 April 2021


27 CAP
STRATEGIC
PLANS

Review of more than 50 farming practices
7 are now available in the wiki

- Organic farming
- Agroforestry
- Fertilisation strategies
  - Organic fertilisation
  - Green manure
  - Enhanced efficiency fertilisers
  - Nitrification inhibitors
  - Low ammonia emission techniques

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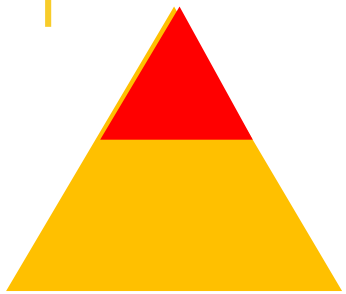
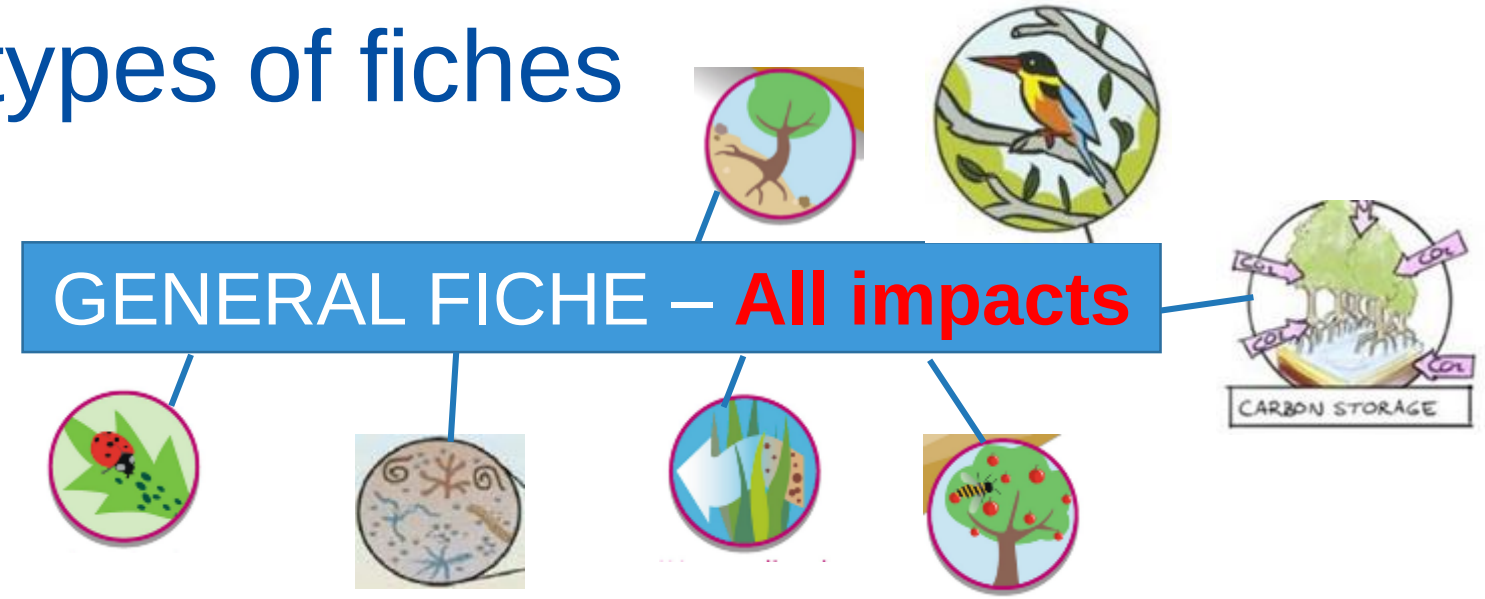
The fiches in the wiki

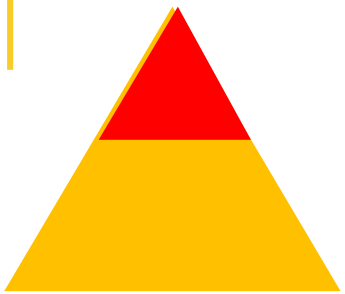
Wiki: three types of fiches



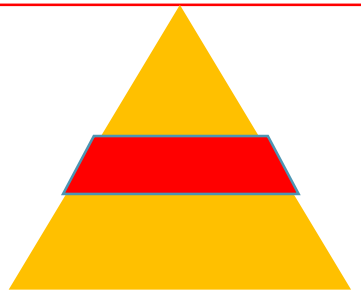


Sources images: PBL,WUR, CICES 2014

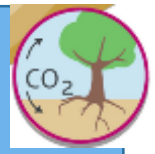
Wiki: three types of fiches



GENERAL FICHE – All impacts



SINGLE FICHE Carbon sequestration

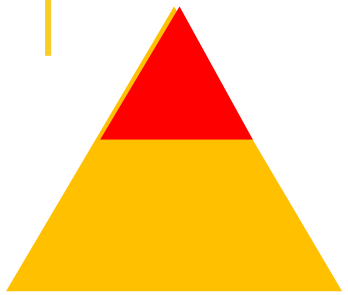


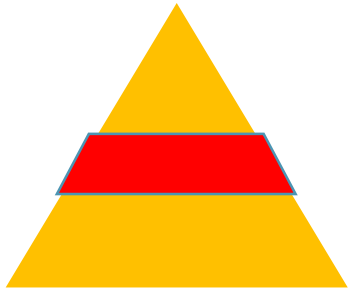
SINGLE FICHE Biodiversity

SINGLE FICHE Soil fertility

SINGLE FICHE etc…

Wiki: three types of fiches





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SINGLE FICHE Carbon sequestration

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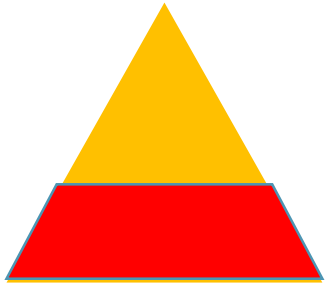


SUMMARIES Carbon sequestration

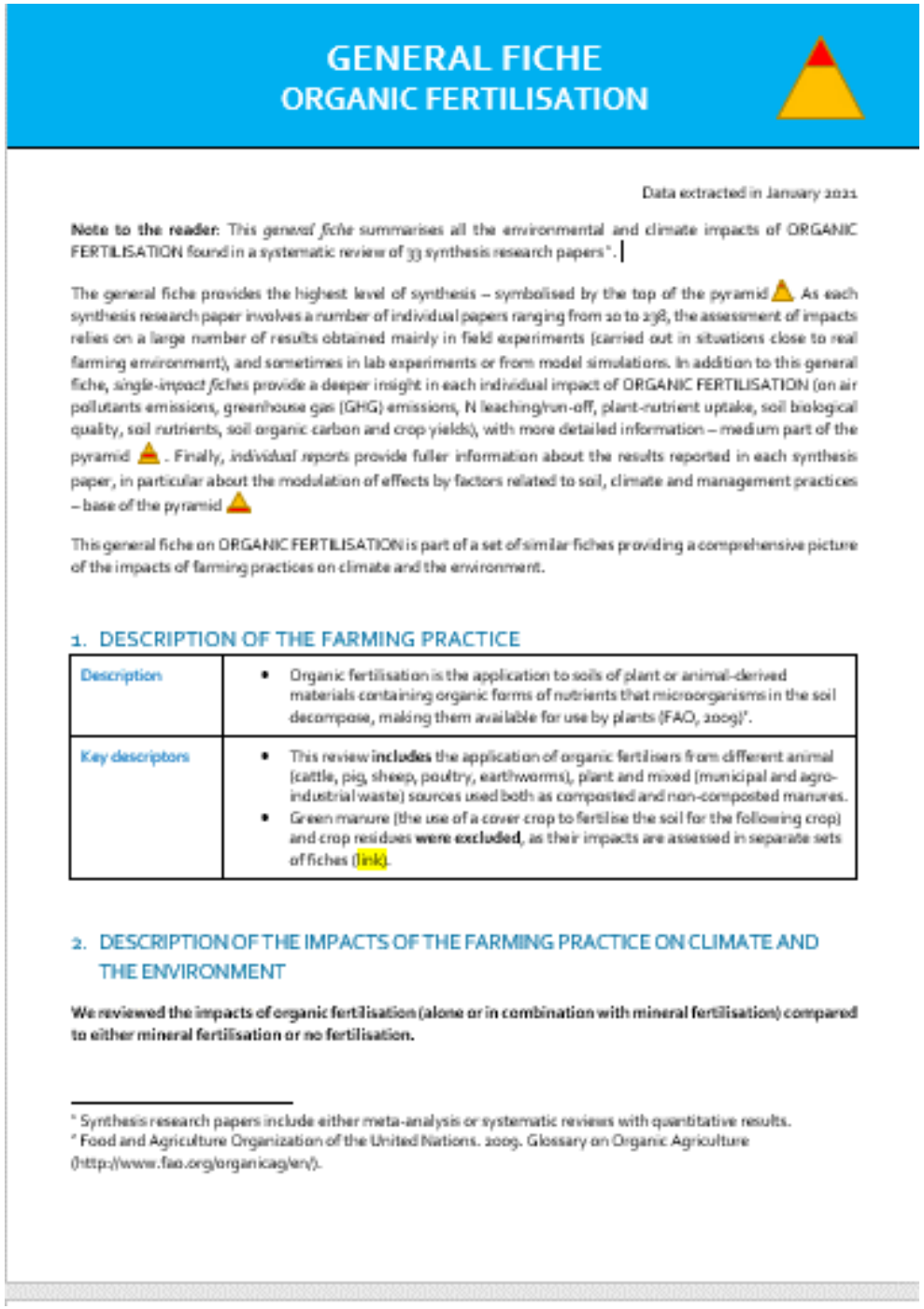
SUMMARIES Biodiversity

SUMMARIES Soil fertility

SUMMARIES etc…

General fiche

1. Description of the farming practice
2. Description of the impacts
3. Description of the key influencing factors
4. Implementation in 2014-2020
5. Pictures
6. Links to other complementary information
7. List of meta-analyses used



GENERAL FICHE
ORGANIC FERTILISATION

Data extracted in January 2021

Note to the reader: This *general fiche* summarises all the environmental and climate impacts of ORGANIC FERTILISATION found in a systematic review of 33 synthesis research papers*.

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 10 to 238, 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 FERTILISATION (on air pollutants emissions, greenhouse gas (GHG) emissions, N leaching/run-off, plant-nutrient uptake, soil biological quality, soil nutrients, soil organic carbon and crop yields), 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 FERTILISATION is part of a set of similar fiches providing a comprehensive picture of the impacts of farming practices on climate and the environment.

1. DESCRIPTION OF THE FARMING PRACTICE

Description	• Organic fertilisation is the application to soils of plant or animal-derived materials containing organic forms of nutrients that microorganisms in the soil decompose, making them available for use by plants (FAO, 2009)*.
Key descriptors	• This review **includes** the application of organic fertilisers from different animal (cattle, pig, sheep, poultry, earthworms), plant and mixed (municipal and agro-industrial waste) sources used both as composted and non-composted manures. • Green manure (the use of a cover crop to fertilise the soil for the following crop) and crop residues **were excluded**, as their impacts are assessed in separate sets of fiches (link).

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

We reviewed the impacts of organic fertilisation (alone or in combination with mineral fertilisation) compared to either mineral fertilisation or no fertilisation.

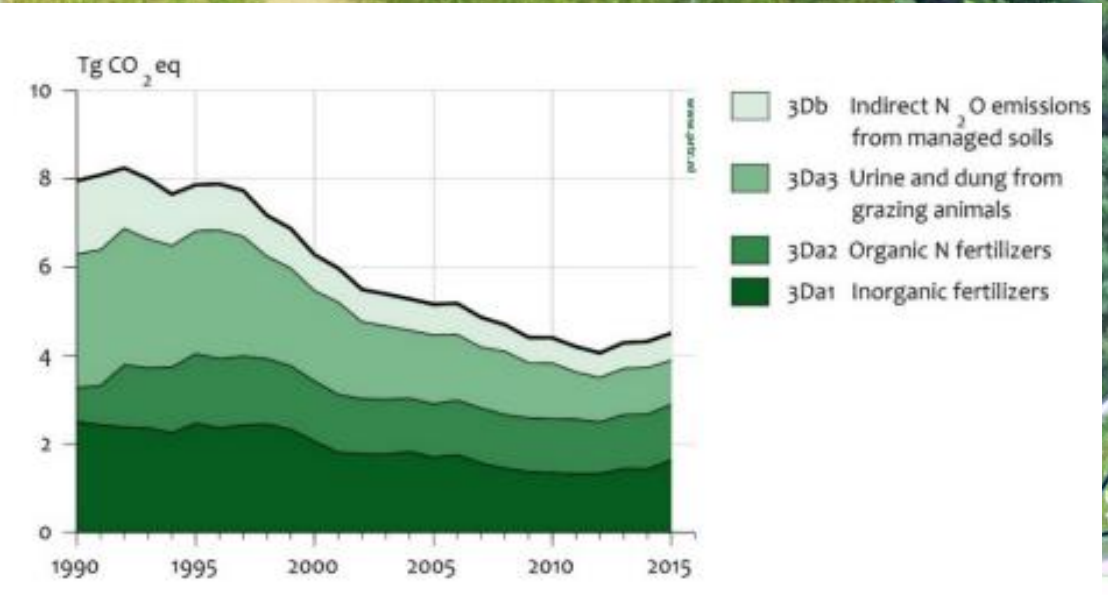
* Synthesis research papers include either meta-analysis or systematic reviews with quantitative results.
* Food and Agriculture Organization of the United Nations. 2009. Glossary on Organic Agriculture (http://www.fao.org/organicag/en/).

Benefits for programming the CAP Strategic Plans

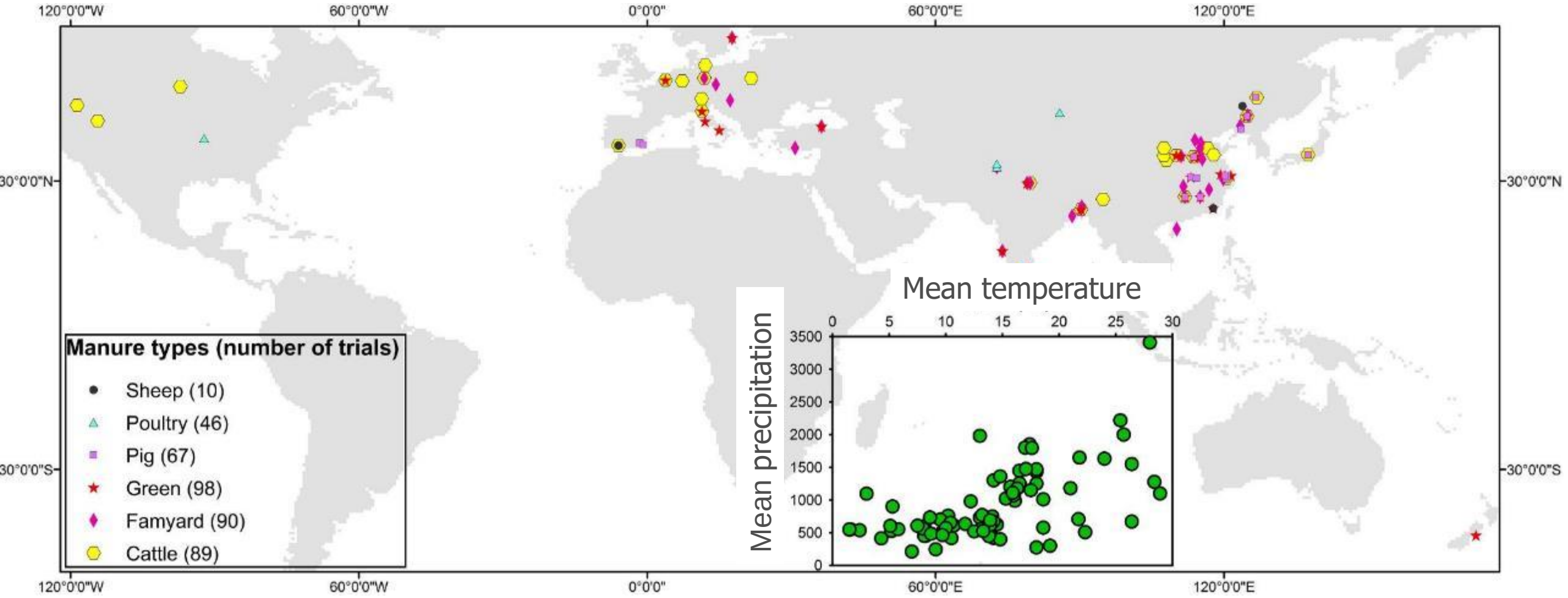
- The fiches help:
  - To identify most suitable farming practices to achieve specific climate and environment objectives (identified in the SWOT analysis and need assessment)
  - To provide a benchmark for comparison, as they are used by Geohub officers to assess Member States CAP plans
  - To gather information on biogeographical, climatic and management factors that influence the environmental, climate and crop yield effects

The method behind the fiches

Evidence from many experiments



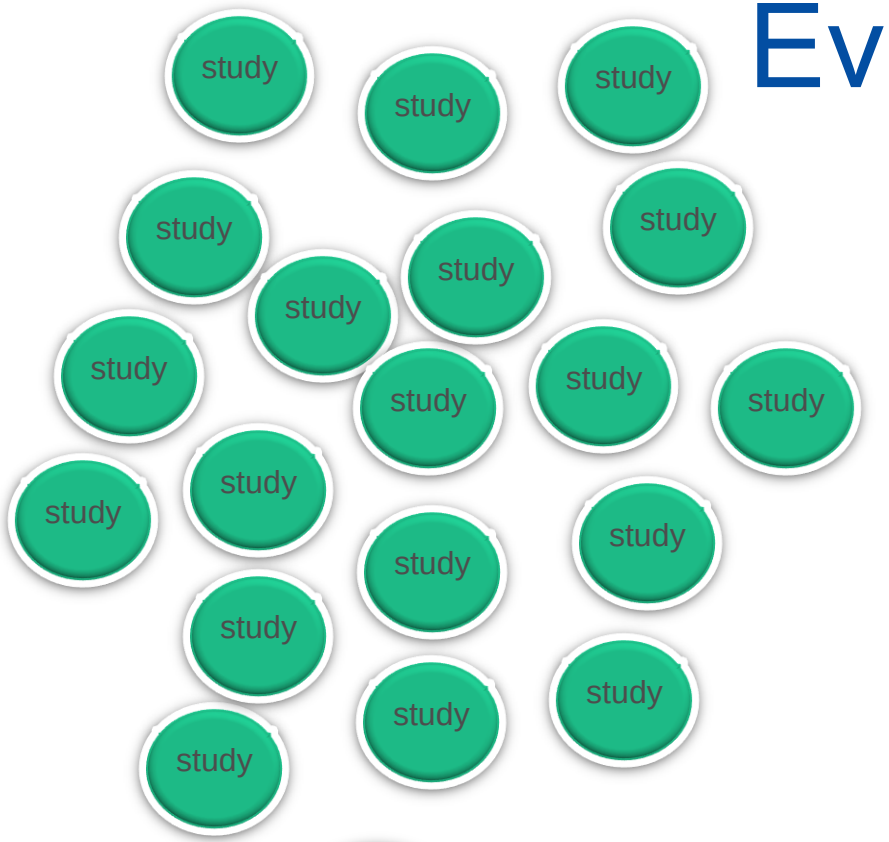
Evidence from many countries



Liu et al (2020) Impact of manure on soil biochemical properties: A global synthesis

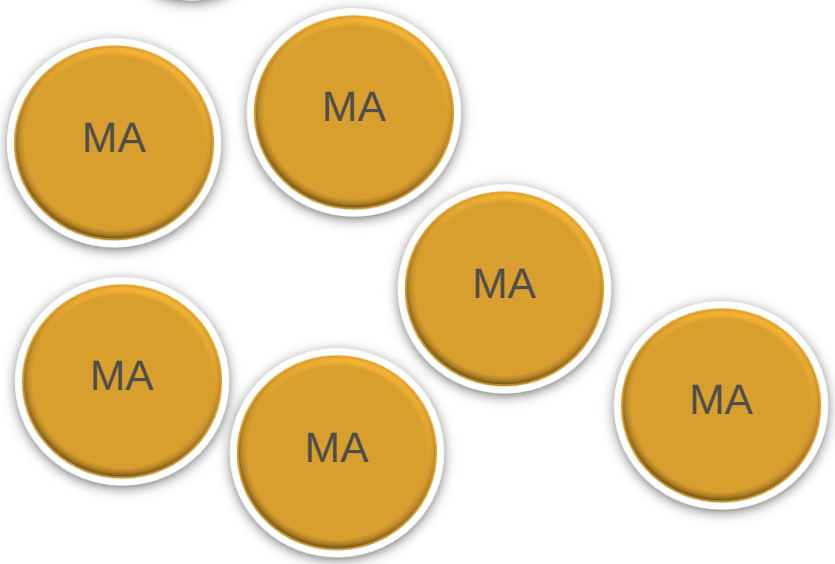
Evidence comes from…

New meta-analysis



Meta-Analysis

Review of **existing** meta-analyses



Reviews of meta-analyses

We check the quality of the meta-analyses

Criterion

1. List of studies
2. Selection criteria
3. Objective specified
4. Databases mentioned
5. Search string
6. Number of studies at each step of the selection process
7. Quantitative results described
8. Statistical methods described
9. Individual effect sizes presented
10. Individual effect sizes weighted
11. Dataset available
12. Confidence intervals presented
13. Method of data extraction described
14. Heterogeneity of results analyzed
15. Funding sources mentioned
16. Publication bias analyzed

Scores (0 or 1)

8/16 = 50%
our quality threshold

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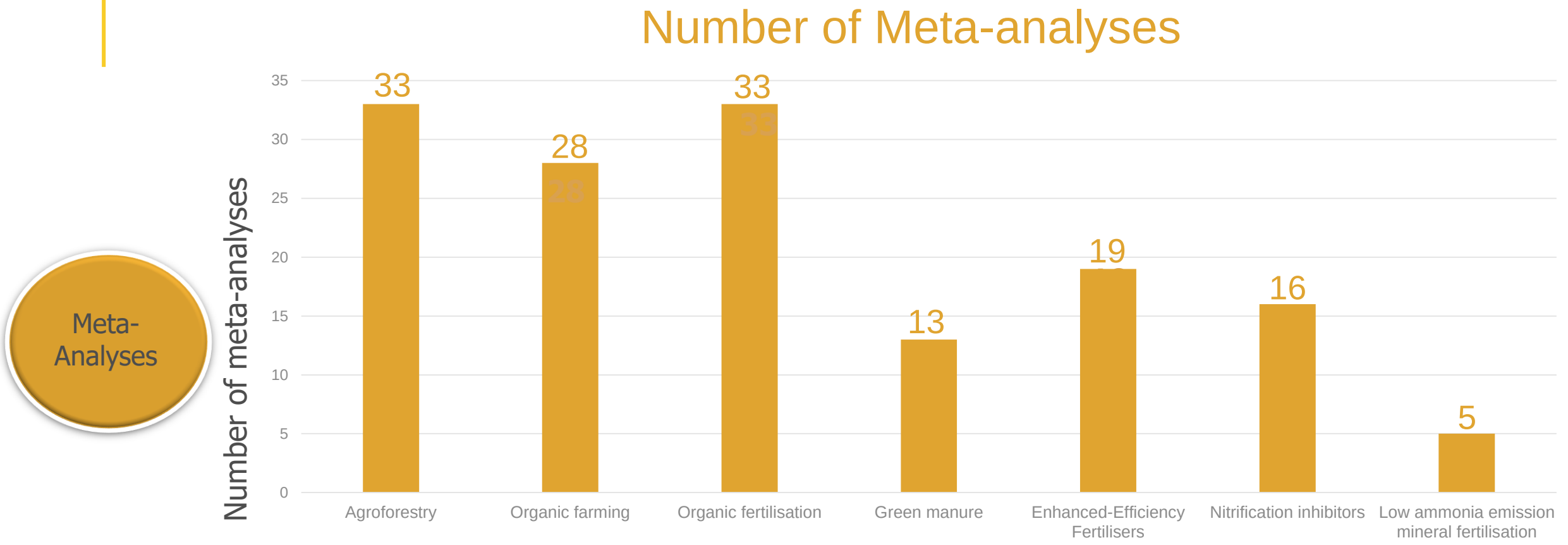
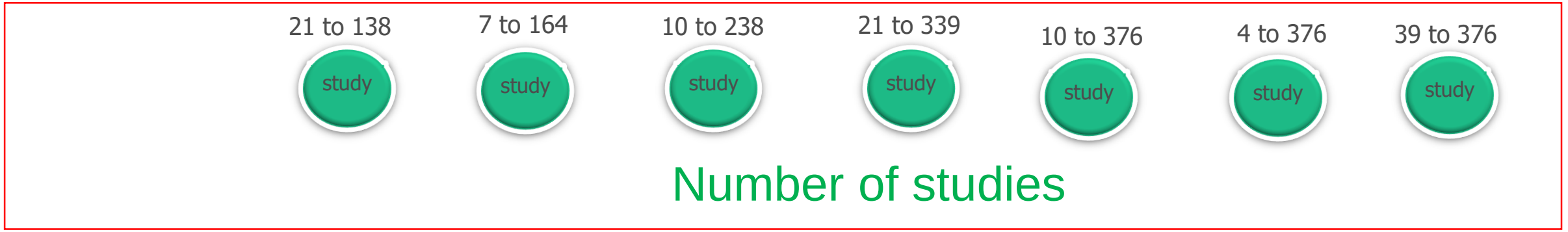
Hundreds of experimental studies available





Reviews of 28 meta-analysis

Effects of organic farming (per ha)

Compared to conventional farming

POSITIVE

- Increase carbon sequestration
- Decrease greenhouse gas emissions
- Increase biodiversity
- Etc.

NO EFFECT

NEGATIVE

- Decrease yield
- Increase pest and diseases

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Reviews of 28 meta-analysis

Effects of organic farming

Compared to conventional farming

POSITIVE **NO EFFECT** **NEGATIVE**

	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	**1 (0)**	0	**1**	0		0	**1**	0	0
Increase carbon sequestration	**8 (6)**	0	1*	0		0	0	0	0
Decrease eutrophication	**1**	0	0	0		0	**2**	0	0
Decrease acidification	0	0	0	0		0	**1**	**1**	0
Decrease greenhouse gas emissions	**2**	0	1	0		1 (0)	**2**	**2**	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		0	0	0	0
Decrease of agricultural land use	0	0	0	0		0	**2**	0	0
Decrease energy use	**1 (0)**	0	0	0		**3 (2)**	1	1	0

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Relevance of the fiches for programming CAP Strategic Plans

- The fiches help:
  - to prepare the CAP strategy
  - to design the intervention

- The method behind the fiches ensures a decision that is based on robust scientific evidence with a low risk of bias

Overall matrix

Farming practices → Impacts → CAP specific objectives

	CAP objectives / environmental and climate themes												
	CAP specific objective												
	d. Contribute to climate change mitigation and adaptation, as well as sustainable energy				e. Foster sustainable development and efficient management of natural resources such as water, soil and air					f. Contribute to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes			i. Improve the response of EU agriculture to societal demands on food and health, including safe, nutritious and sustainable food, as well as animal welfare
	GHG emissions	Carbon sequestration/ storage	Climate change adaptation	Energy use	Air quality	Water quality	Water quantity and availability	Soil quality and fertility	Soil erosion	Biodiversity	Pollination	Landscape quality	Pest and disease control
Agroforestry practices													
Organic farming practices													
Nitrification inhibitors													
Organic fertilization													
Fertilisation using green manure													
Fallowing of arable land													
Buffer strips along water courses													
Hedgerows and wooded strips													
Trees in line													
Isolated trees													
Trees in group and field copses													
.....													

theme

Farming practices

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Overall matrix

Impact legend:
positive
negative
no effects
uncertain
no evidence

!

	CAP objectives / environmental and climate themes												
	d. Contribute to climate change mitigation and adaptation, as well as sustainable energy				e. Foster sustainable development and efficient management of natural resources such as water, soil and air					f. Contribute to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes			i. Improve the response of EU agriculture to societal demands on food and health, including safe, nutritious and sustainable food, as well as animal welfare
	GHG emissions	Carbon sequestration/ storage	Climate change adaptation	Energy use	Air quality	Water quality	Water quantity and availability	Soil quality and fertility	Soil erosion	Biodiversity	Pollination	Landscape quality	Pest and disease control
Agroforestry practices	Decrease greenhouse gas emissions	Increase carbon sequestration	Increase water retention				Increase water retention	Increase soil nutrients/Increase SOC	Soil erosion control	Increase biodiversity	Increase pollination		Improve pest and disease-control
Organic farmi				Decrease energy use	Decrease ammonia emissions	eutrophication/ decrease nutrient loss		Decrease acidification /increase SOC (+)		Increase biodiversity	Increase pollination		Improved pest and disease control
Deep placement	Decrease												
Irrigation after fertilization					Decrease ammonia emissions								
Split application of N fertilizer over more dates	Decrease greenhouse gas emissions				Decrease ammonia emissions	Decrease N leaching							

Impact

hyperlink to the farming practice fiche

In wiki, the matrix is the entry point to the fiches

Questions ?



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Wiki demonstration

A Schievano, ML Paracchini (JRC-D5)

GREX meeting, 27 April 2021

Expand all | Collapse all

- Home
  - IMPACTS of FARMING PRACTICES on ENVIRONMENT and CLI...
  - INVENTORY OF LEGISLATION

(M)odifica

Home

Creato da Sebastien BLANDIN, ultima modifica di Andrea SCHIEVANO il apr 20, 2021

IMAP WIKI under construction. Official release in a few days

IMAP wiki is a platform to facilitate the implementation and evaluation of the CAP Strategic Plans, in particular for the objectives linked to climate and the environment.

The support includes:

Impacts of farming practices on Environment and Climate

European Commission

IMPACTS of FARMING PRACTICES on ENVIRONMENT and CLIMATE

Creato da Augusta BANDE, ultima modifica di Andrea SCHIEVANO 11 minuti fa

How to NAVIGATE

The navigation in this portal can start from:

- the **Synthetic matrix of the impacts** (an overview table of all farming practices and their impacts).
- each single **Farming practice fiches** (using a tree structure, one can access each fiche associated to a farming practice).

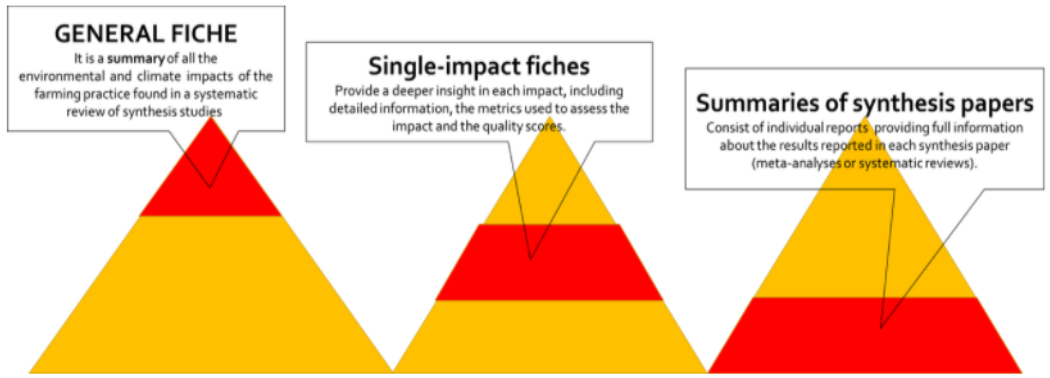
The navigation is facilitated by hyperlinks within each fiche. Each fiche can also be downloaded, in pdf format.

Methodology used for the synthesis of scientific evidence

The **impacts of farming practices** on climate an the environment are assessed through a **systematic review of synthesis studies**

(including either **meta-analyses** or **systematic reviews** with quantitative results).

For each farming practice, the results are reported in the following **types of fiches**, with increasing level of synthesis:



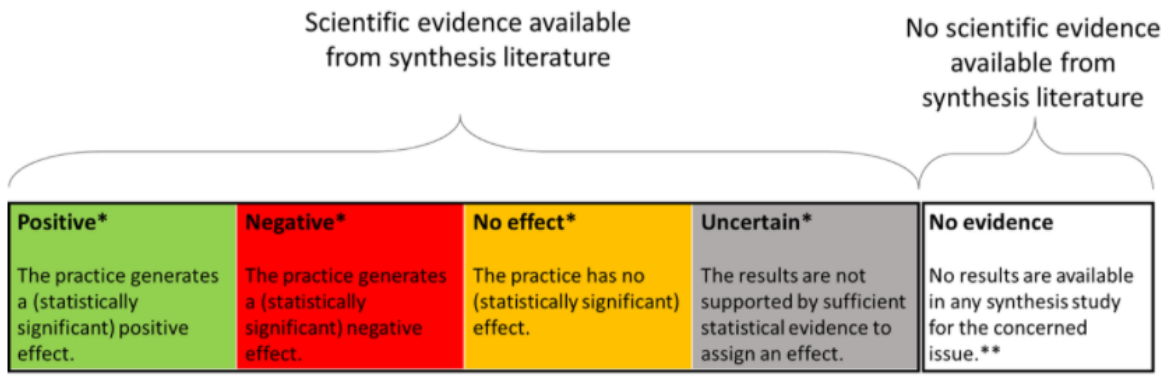
The overall effect of each farming practice on a specific impact is based on the scientific evidence found in **all synthesis studies available in the literature**.

As each synthesis study involves a **number of individual studies**, the assessment of impacts relies on **a large number of results** obtained mainly in

field experiments, and sometimes in lab experiments or from model simulations.

The **overall effect** is represented by a **colour**, both in the synthetic matrix and in the farming practice fiches.

Impact legend:



*The **number of synthesis papers** reporting each effect is indicated in the fiche. The attribution of the colour reflects the predominant effect (i.e. it will be positive if 4 synthesis studies report a positive effect, while 3 report a negative/no effect).

** For all potential environmental/climate impacts that are not included (either in the Fiches or left in blank in the synthetic matrix), there is **no available evidence in the existing synthesis studies** (systematic reviews and meta-analyses).

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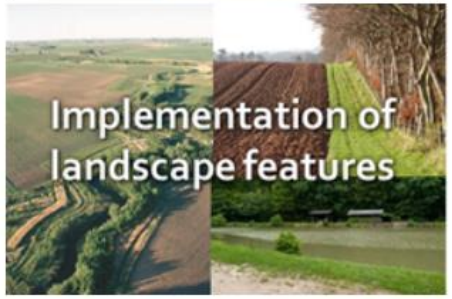
Farming practices fiches

Creato da Augusta BANDE, ultima modifica di Andrea SCHIEVANO un momento fa



Mi piace Sii il primo a mettere "mi piace"

Nessuna etichetta

Organic fertilisation_GENERAL

Creato da Michael ASSOULINE, ultima modifica di Andrea SCHIEVANO il apr 15, 2021

GENERAL FICHE - ORGANIC FERTILISATION

Download the general fiche

Data extracted in January 2021

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Key descriptors	· This review **includes** the application of organic fertilisers from different animal (cattle, pig, sheep, poultry, earthworms), plant and mixed (municipal and agro-industrial waste) sources used both as composted and non-composted manures.

Impact	Metric	Comparator							
		Mineral fertilisation				No fertilisation			
		Positive	Negative	No effect	Uncertain	Positive	Negative	No effect	Uncertain
Decrease Air pollutants emissions	NH3 emissions*	**2 (2)**	0	1 (1)	0	0	0	0	0
	NO emissions*	0	0	0	0	0	**1 (1)**	0	0
Decrease GHG emissions	CH4 emissions *	0	**1 (1)**	**1 (1)**	0	0	**1 (1)**	0	0
	CO2 emissions*	0	**1 (1)**	0	0	0	**1 (1)**	0	0
	N2O emissions*	1 (1)	2 (2)	**6 (6)**	0	1 (1)	**5 (5)**	1 (1)	0
Decrease N leaching/run-off		**1 (1)**	0	0	0	0	0	0	0
Increase Nitrogen use efficiency		0	**1 (1)**	**1 (1)**	0	0	0	0	0
Improve Soil biological quality		**4 (4)**	0	0	0	**3 (3)**	1 (1)	1 (1)	0
Increase Soil nutrients		**5 (4)**	0	2 (1)	0	**4 (4)**	0	1 (1)	0
Increase Soil organic carbon		**7 (7)**	0	0	0	**6 (6)**	0	1 (1)	0
Increase Crop yield		2 (2)	1 (1)	**4 (4)**	0	**5 (5)**	0	0	0

* accounting only for emissions resulting from fertiliser application.

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

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

Impact	Factors
Decrease Air pollutants emissions	Duration of treatment (Ref.7), N application rate (Ref.20), organic fertiliser application rate (Ref.7), soil C/N ratio (Ref.20), soil mineral N (Ref.20), soil organic carbon (Ref.20), soil pH (Ref.20), soil texture (Ref.20)
Decrease GHG	Annual precipitation (Ref.32), climate (Ref.8, Ref.23), crop type (Ref.8, Ref.30), difference in total N inputs between organic and mineral fertilisers (Ref.19), duration of treatment (Ref.7, Ref.8), mean annual temperature (Ref.32, N application rate (Ref.30). organic fertiliser application rate (Ref.2, Ref.7), organic fertiliser C/N ratio (Ref.17, Ref.19), organic fertiliser N

IMAP

Organic fertilisation_Impacts

Creato da Michael ASSOULINE, ultima modifica di Andrea SCHIEVANO un minuto fa

- Organic fertilisation_Impacts_Air pollutants
- Organic fertilisation_Impacts_Crop yield
- Organic fertilisation_Impacts_Greenhouse gas emission
- Organic fertilisation_Impacts_Nitrogen leaching
- Organic fertilisation_Impacts_N use efficiency
- Organic fertilisation_Impacts_Soil biological quality
- Organic fertilisation_Impacts_Soil nutrients
- Organic fertilisation_Impacts_Soil organic carbon

Mi piace Sii il primo a mettere "mi piace"

Nessuna etichetta

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SINGLE-IMPACT FICHE
ORGANIC FERTILISATION

IMPACT: SOIL ORGANIC CARBON

Data extracted in January 2021

Note to the reader: This fiche summarises the impact of organic fertilisation on SOIL ORGANIC CARBON. It is based on 10 peer-reviewed synthesis research papers[1], each of them including from 10 to 238 individual studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT: Organic fertilisation (alone or in combination with mineral fertilisation) has a positive effect on soil organic carbon (i.e., increase of soil organic carbon) according to most of the reviewed synthesis papers, irrespective of whether the comparator is mineral fertilisation or no fertilisation (see **Table 1**).
  When compared to mineral fertilisation, the 7 synthesis papers reviewed reported a positive effect.
  When compared to no fertilisation, 6 out of 7 synthesis papers reviewed reported a positive effect, while 1 reported no effect.

  Among the 10 reviewed synthesis papers, 9 include data collected in Europe. The other synthesis paper reports studies conducted at the global scale but does not specify where (see **Table 2**).

Organic fertilisation_Summaries

Creato da Michael ASSOULINE, ultima modifica di Andrea SCHIEVANO circa 3 ore fa

- Organic fertilisation_Summaries_Air pollutants
- Organic fertilisation_Summaries_Bio quality
- Organic fertilisation_Summaries_GHG emissions
- Organic fertilisation_Summaries_Leaching
- Organic fertilisation_Summaries_NUE
- Organic fertilisation_Summaries_SOC
- Organic fertilisation_Summaries_Soil nutrients
- Organic fertilisation_Summaries_Yield

Mi piace Sii il primo a mettere "mi piace" Nessuna etichetta

Scrivi un commento

Organic fertilisation

Impact: Air pollutants emissions

Reference 7

Wei, ZB; Ying, H; Guo, XW; Zhuang, MH; Cui, ZL; Zhang, FS 2020 Substitution of Mineral Fertilizer with Organic Fertilizer in Maize Systems: A Meta-Analysis of Reduced Nitrogen and Carbon Emissions AGRONOMY, 10, 1149. 10.3390/agronomy10081149

Background and objective

Organic fertilizer is an effective substitute for mineral fertilizer that improves crop yield and is environmentally friendly. However, the effects of substitution often vary due to complicated interactions among the organic fertilizer substitution rate, total nutrient supply, and type of cropping system used. To quantitatively assess the effects of substituting organic fertilizers for mineral fertilizers on maize production, N and C emissions, and the soil organic carbon sequestration rate (SOCSR). We also evaluated the global warming potential (GWP) and net global warming potential (NGWP), considering the indirect effects of NH3 emissions and runoff/leaching. The responses of these variables to organic fertilizer substitution were evaluated according to the fertilization rate (low, optimal, or high), substitution rates, and treatment duration. The underlying causes of the different responses of these variables to substitution of chemical with organic fertilizer are discussed. Here, results on NH3 emissions are reported.

Search strategy and selection criteria

Studies published before March 2020 were searched for in the Microsoft Academic, Google Scholar, Baidu Scholar, and China National Knowledge Infrastructure databases. Search terms related to maize production, organic fertilizer substitution, manure application, and N and C emissions were combined. 1) Studies focused on maize production with substitution of mineral fertilizer with organic fertilizer, including animal manure (47%), compost (37%), commercial organic fertilizer (e.g., industrially processed, standardized poultry or livestock manure; 9%), digestate (5%), slurry (2%); 2) The amounts of applied organic material and the N content were clearly specified; 3) The mineral fertilizer treatment and “substitution treatments” (partial or full substitution of chemical with organic fertilizer) had identical total N rates, and

Inventory of legislation

European Commission

Objective of the inventory of legislation

- common repository and easy access for information related to environmental legislation relevant for CAP plans and indicators
- aggregation of already published information, including at MS – regional level depending on the relevant choices for each legislation (e.g. fertilization limits)
- As several subjects undertake many initiatives on indicators (new dashboards and knowledge centers), we are working mostly on the side of legislation to avoid duplicates
- Use in the CAP plan drafting/assessment process:
  - support SWOT – needs assessment
  - clearer baseline for environmental interventions
- This section of the wiki is maybe more relevant at EU level , but we believe MS can also find it useful

INVENTORY OF LEGISLATION

Creato da Michael ASSOULINE, ultima modifica il apr 16, 2021

This section contains information on EU legislation concerning the environment and climate to whose objectives Member States' Cap Strategic Plans should contribute pursuant to Articles 96, 97 And 103 of COM(2018) 392 final.

The different sections guide users throughout legislation requirements and ways to access related information (web links, repositories).

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The National Emission Ceilings Directive (NECD)

Creato da Maria BIELZA, ultima modifica il mar 12, 2021

General description

The **National Emission Ceilings Directive -NECD-** (2016/2284/EU) regulates the concentration of pollutants in the air to move towards achieving levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment. Replacing earlier legislation (Directive 2001/81/EC), the NECD sets 2020 and 2030 emission reduction commitments for the periods 2020 – 2029 as well as 2030 and beyond for five main air pollutants. It also ensures that the emission ceilings for 2010 set in the earlier directive remain applicable for Member States until the end of 2019. Emission ceilings to be achieved until the end of 2019 are defined in absolute terms (in Gg of pollutant). From 2020 onwards the emission ceilings are defined as a reduction relative (in %) to the countries' emission levels in 2005.

The NECD sets national emission reduction commitments (NERCs) for Member States and the EU for five important air pollutants:

- nitrogen oxides (NOx),
- non-methane volatile organic compounds (NMVOCs),
- sulphur dioxide (SO2),
- ammonia (NH3) and

Thank you for your attention
Questions ?



European Commission