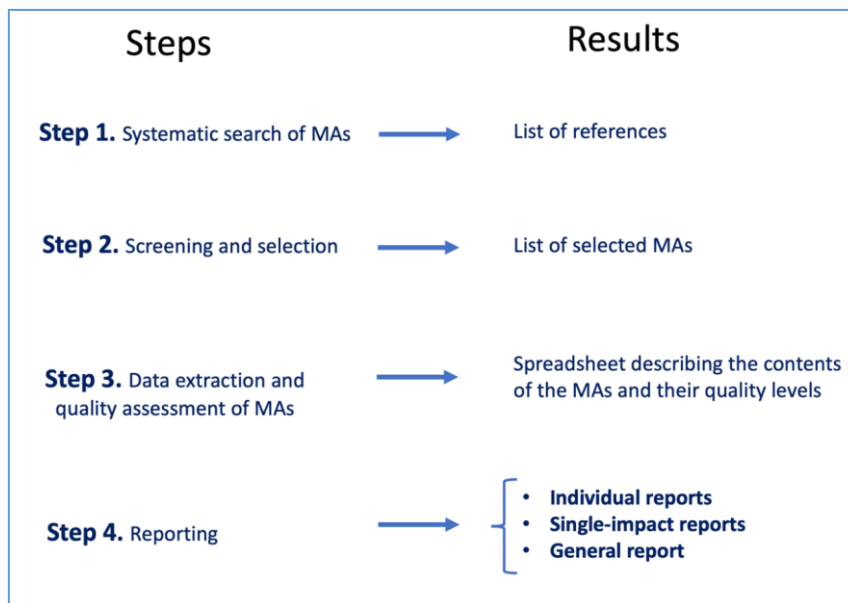


Methodology

Background: We synthesise large amount of available data to assess whether farming practices have positive or negative effects on the environment. Our starting point are the relatively large number of **meta-analyses (MA)** published in agricultural science. A meta-analysis is the **systematic statistical synthesis of the published results of many independent individual experiments**. We use them to assess the impact of farming practices on a variety of outcomes, including crop and livestock productions, biodiversity, greenhouse gas emissions, nitrate leaching, soil organic carbon, based on a large number of experimental data. MA has become a gold standard method for quantitative research synthesis, and scientists can use the growing number of MAs available to inform decisions of policy makers. However, published MAs have different content and quality.

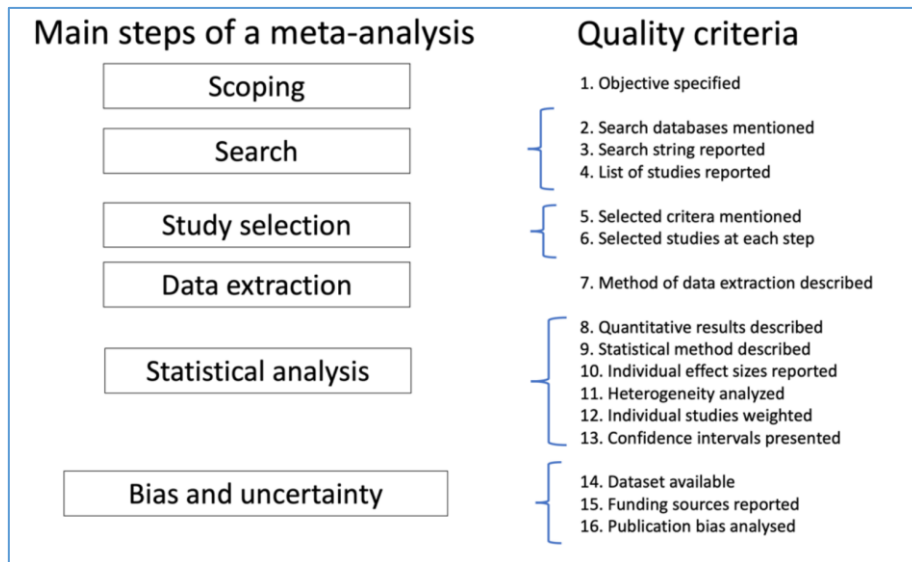
Method: We have developed a methodological framework for assessing the impacts of farming practices on the environment and climate based on a **Systematic review of published meta-analyses**. The framework helps to report the results and quality levels of MAs in a rigorous and transparent manner. In addition, the framework can be implemented quickly - within weeks - to be operational and compatible with the time constraints of modern policymaking processes.

The framework includes four main steps: (1) literature search of existing MAs, (2) screening and selection of MAs, (3) data extraction and quality assessment, and (4) reporting.



Quality criteria: We assess each MA using 16 quality criteria covering different aspects of the MAs

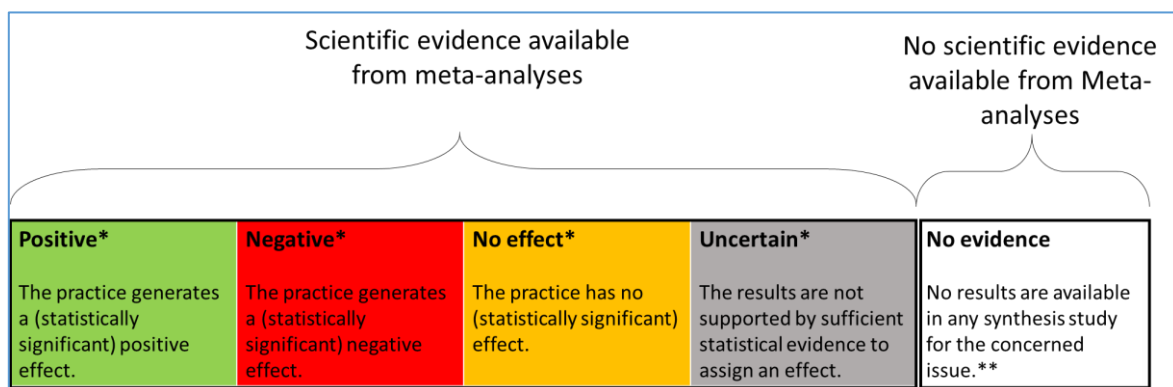
- Scoping (definition of the objective of the MA)
- Search (search of potentially relevant individual published studies)
- Study selection (selection of the relevant individual studies)
- Data extraction (extraction of the experimental data useful for computing the effect sizes)
- Statistical analysis (analysis of the data to estimate the mean effect size and analyze between-study variability)
- Bias and uncertainty (analysis of the uncertainty of the results and analysis of the risk of bias).



Results:

We assess the overall effect of each farming practice on a specific impact based on the scientific evidence found in the published MAs. As each MA involves a number of individual studies, the assessment of impacts relies on the statistical analysis of a large number of results obtained mainly in field experiments, and sometimes in lab experiments or from model simulations.

We represent the effect by a colour as shown below, according to the statistical analysis provided by MAs.



Three types of reports are generated from the extracted data:

- **General Fiches:** individual reports summarising the contents of each MA (MA summary reports),

- **Impact fiches:** reports summarising each of the impacts of a given farming practice on a specific environmental, climate mitigation, or production outcome (single-impact reports)
- **Summaries of the meta-analyses:** reports summarising all the impacts of a given farming practice on all the outcomes considered (general report).

Advantages: The methodological framework is semi-automatic in the sense that the outlines of the reports are generated automatically from the spreadsheet used for the data extraction and quality assessment. This semi-automatic procedure allows scientific experts to reduce the time needed in the reporting step. Since 2020, the framework is successfully applied by a group of scientific experts to support decisions of EU policy makers, and examine the large diversity of single farming practices presented in this WIKI in a relatively short time. It provides an operational tool for scientists who want to supply policymakers with scientific evidence based on large numbers of experiments, in a timely and reproducible manner. In addition, the reported results provide a wealth of information to those interested in the environmental and climate impacts of agricultural practices that Member States can apply through their Common Agricultural Policy Strategic Plans.

Reference: DOI: [10.31219/osf.io/byuw9](https://doi.org/10.31219/osf.io/byuw9)