A systematic review of methods for assessing the performance of conservation agriculture and its ability to cope with climate change in temperate zones

Sophie Plassin, Marine Albert, Magali Willaume, Jacques-Eric Bergez

Conservation Agriculture and Climate Change
A systematic literature review of methods

Sophie Plassin, Marine Albert, Magali Willaume, Jacques-Eric Bergez
AGIR, Univ Toulouse, INRAE, Castanet-Tolosan, France

Introduction

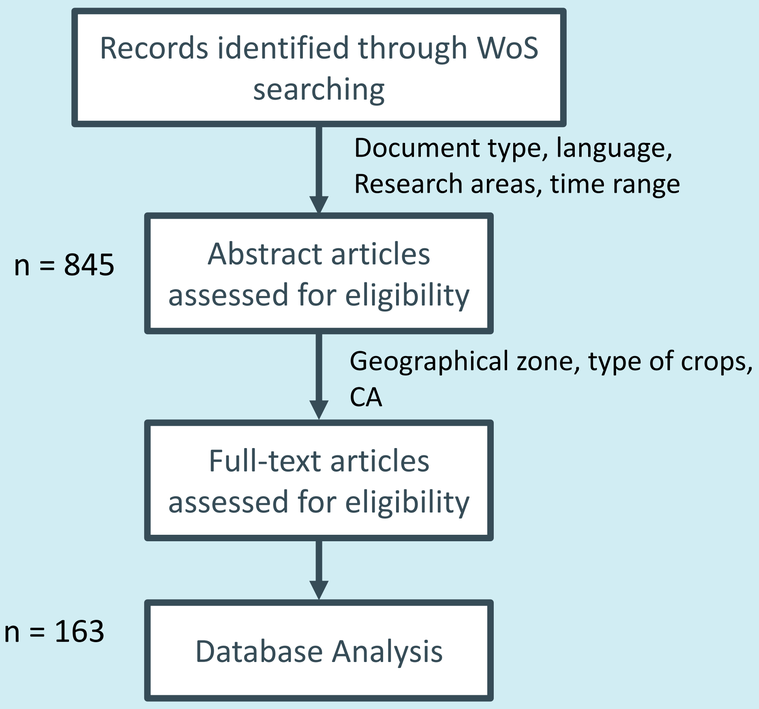
- Cropping systems in temperate zones are suffering from climate change, which is expected to cause more damage in the future
- Conservation Agriculture (CA) could be an alternative for addressing the negative impacts of climate change on cropping systems.
- CA is based on three pillars, with a wide range of practices for each pillar:
    - Pillar 1: Minimum mechanical soil disturbance
    - Pillar 2: Crop diversification
    - Pillar 3: Maintaining soil cover
- A growing number of studies have evaluated the effects of CA on cropping systems performance, but an overview of the type of pillars and practices tested, the diversity of pedoclimatic conditions and methods used, and the type of climate change impacts and associated performance assessed is lacking.
- It is important to synthesize the research activity on this topic to identify knowledge gaps and provide guidelines for future research.

Objectives

- Gather studies assessing the effectiveness of CA in the face of climate change in temperate zones through a systematic literature review (SLR)
- Synthesize information related to a diversity of contexts (type of soil, geographic location), study design, set of practices, and evaluated performance

Methods

Steps of the screening based on Cochrane protocol



Eligibility criteria

Criteria	Elegibility
Spatial scale	Plot or Farm
Type of crops	Maize, corn, wheat, barley, sunflower, soybean, rapeseed, sorghum, triticale, pea
Geographical zone	Temperate zone

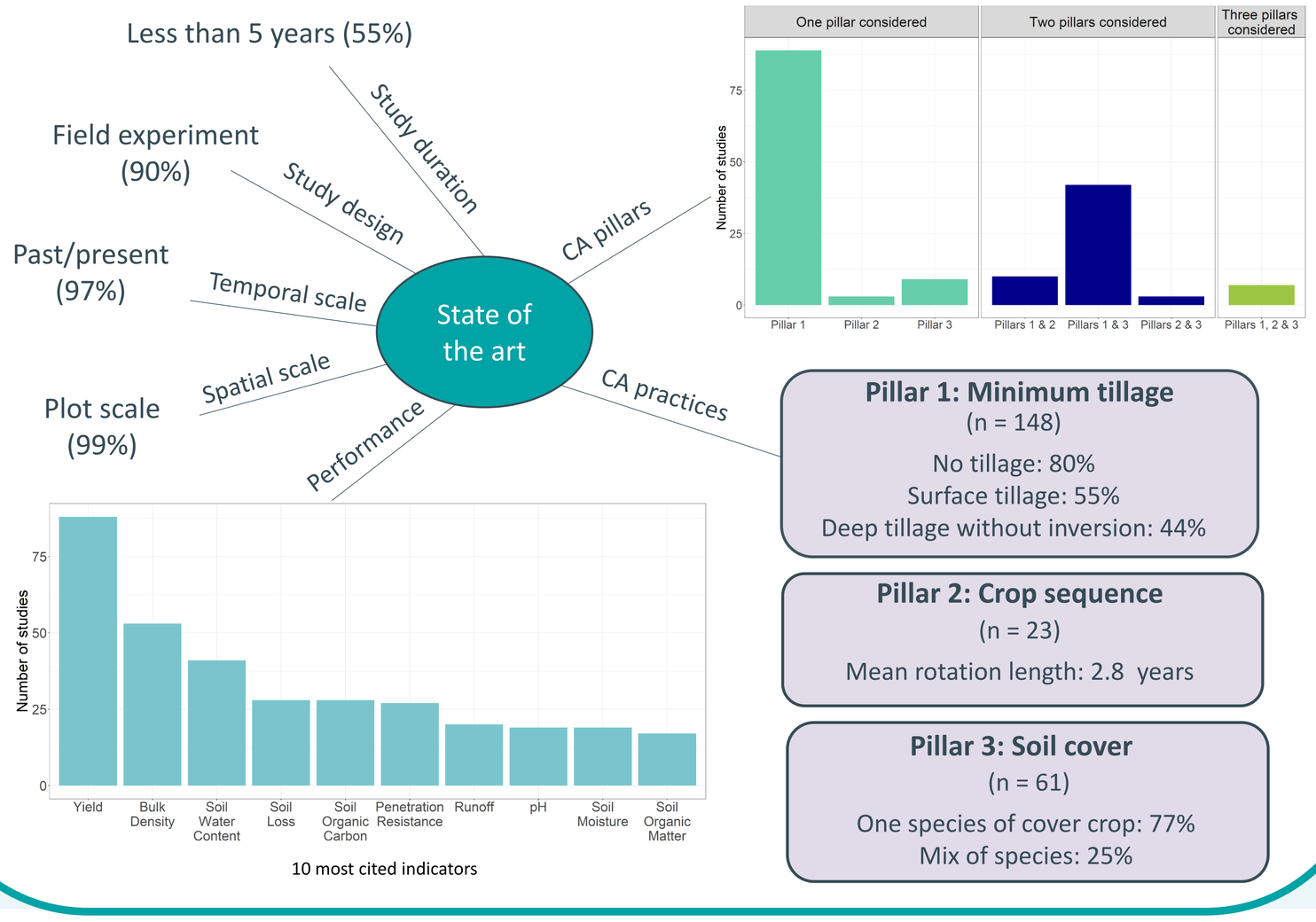
Search query = CA and synonyms AND **CA practices** AND **Crop types** AND **Climate change impacts**

Statistical analysis

Variables: Study duration, Study design, Soil type, Climate change impacts, Temporal and Spatial scale, Crops, CA pillars, CA practices, Performance indicators…

Descriptive analysis + factorial analysis

Results



Pillar 1: Minimum tillage
(n = 148)

No tillage: 80%
Surface tillage: 55%
Deep tillage without inversion: 44%

Pillar 2: Crop sequence
(n = 23)

Mean rotation length: 2.8 years

Pillar 3: Soil cover
(n = 61)

One species of cover crop: 77%
Mix of species: 25%

Discussion - Conclusion

→ Most studies focused on the effects **of one or two pillars**, and mainly on minimum tillage

→ Most studies assessed **agronomic performance**

→ Results not sufficiently contextualized according to **pedoclimatic conditions**

→ Perspectives for future research:

- Design **On-Farm Experiment** to take into account framers' constraints
- Use **systemic** and **interdisciplinary** approaches
- Conduct **Vulnerability and Resilience** assessment
- Simulation in **future climate**
- Complete this qualitative synthesis with a **meta-analysis**

Contact: sophie.plassin@inrae.fr

INRAE, Centre Occitanie – Toulouse
24 Chemin de Borde Rouge
Auzeville - CS 52627
31326 Castanet Tolosan Cedex
FRANCE