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A Systematic Review of behavioural change approaches for sustaining conservation agriculture adoption and climate resilience among smallholder farmers

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ADMINISTRATIVE INFORMATION

Support - FACENDC PhD Scholarship.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202680082**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 21 August 2026 and was last updated on 21 August 2026.

INTRODUCTION

Review question / Objective Review question

Among smallholder farmers (P), how do behavioural change approaches for conservation agriculture (I), compared with limited or no exposure to such approaches (C), improve the sustained adoption of conservation agriculture (O) across empirical study designs (S)?

Review Objectives

1. To assess the effectiveness of behavioural change approaches in promoting the adoption of conservation agriculture among smallholder farmers.
2. To identify barriers to the sustained adoption of conservation agriculture among smallholder farmers.
3. To identify enablers of the sustained adoption of conservation agriculture among smallholder farmers.
4. To examine the contribution of sustained conservation agriculture adoption to smallholder farmers' climate resilience.

Rationale Conservation agriculture (CA) is promoted as an approach for improving the sustainability and climate resilience of smallholder farming systems. However, evidence from the included studies indicates that initial adoption does not necessarily lead to sustained use. Studies from Malawi, Zambia, Zimbabwe and Mozambique report differences in the speed, intensity and persistence of CA adoption, including partial adoption and subsequent dis-adoption (Chinseu et al., 2019; Habanyati et al., 2020; Nyathi et al., 2021; Khainga et al., 2021; Ngoma et al., 2024; Pangapanga-Phiri et al., 2024). Sustained adoption is therefore a distinct concern from initial uptake and is important to the longer-term contribution of CA to climate resilience.

Evidence further shows that CA adoption is influenced by behavioural, social, economic and institutional factors. Farmers' attitudes, motivations, risk preferences, perceived benefits, access to information and social influence affect adoption decisions (Van Hulst & Posthumus, 2016; Abadi et al., 2020; Bell et al., 2018; Robertson et

al., 2018; Simutowe et al., 2024). Social and institutional networks, peer learning and extension approaches also shape adoption (Abdulai et al., 2021; Bell et al., 2018). At the same time, constraints related to finance, labour, inputs, extension support, policy coherence and sociocultural conditions can limit continued use (Chinseu et al., 2019; Habanyati et al., 2020; Dougill et al., 2018; Men et al., 2024). These findings indicate that sustained CA adoption cannot be explained by technical knowledge or individual motivation alone.

Several behavioural change approaches have been used to promote CA, including farmer field schools, participatory advisory approaches, demonstration plots, lead-farmer models, peer learning, farmer-to-farmer extension, repeated demonstrations and behavioural nudges (Bell et al., 2018; Brown et al., 2018; Bourne et al., 2020; Holden et al., 2018; Cipriano et al., 2022; Khainga et al., 2021; Rola-Rubzen et al., 2023). Although these studies provide evidence on individual approaches and adoption determinants, the evidence remains fragmented. In particular, it is unclear how these approaches contribute to sustained adoption, through which behavioural mechanisms, and under what social, economic and institutional conditions.

A further gap concerns the integration of stakeholder roles and climate resilience. Farmers' decisions are influenced by extension providers, peers, community leaders, farmer groups, government institutions and other actors within agricultural innovation systems (Abdulai et al., 2021; Brown et al., 2018; Kaweesa et al., 2020). CA has also been examined in relation to climate resilience and adaptation (Michler et al., 2019; Sithole & Agholor, 2021; Katunzi et al., 2025), but the pathway linking behavioural approaches, sustained adoption and climate-resilience outcomes remains insufficiently synthesised.

This systematic review therefore addresses a specific evidence gap: the lack of an integrated synthesis of behavioural change approaches, stakeholder roles, barriers, enabling conditions, sustained CA adoption and climate resilience among smallholder farmers, particularly in low-income and resource-constrained contexts. The review will synthesise evidence on the approaches used, how they influence farmer behaviour, the factors that enable or constrain continued adoption, and their reported contribution to climate resilience. By moving beyond adoption as a one-time or binary outcome, the review seeks to explain what enables CA adoption to persist, why it breaks down, and under what conditions behavioural change approaches can support

sustained and climate-resilient smallholder farming.

Condition being studied The review will examine the sustained adoption of conservation agriculture (CA) among smallholder farmers in low-income and resource-constrained contexts, with particular emphasis on the behavioural, social, economic and institutional conditions that influence whether CA practices are maintained, partially adopted or discontinued over time. The review will consider behavioural change approaches used to promote CA adoption, including farmer field schools, participatory learning and extension, farmer-to-farmer and peer learning, lead-farmer approaches, demonstration plots, repeated exposure to demonstrations and behavioural nudges.

The review will also examine the conditions under which these approaches operate, including farmers' attitudes, motivations, perceived benefits and risks, social influence, access to information, social capital, financial and input constraints, labour requirements, extension support, institutional arrangements, policy coherence, gender and sociocultural factors. Stakeholder roles will be considered where they influence the implementation or sustainability of behavioural change approaches.

The review will further examine reported relationships between sustained CA adoption and climate resilience or climate-change adaptation among smallholder farmers. The condition of interest is therefore not CA adoption as a single-time or binary outcome, but rather the process of behavioural change and continued use of CA practices, including persistence, intensity, partial adoption, and disadoption, as well as the contextual conditions that influence these outcomes.

METHODS

Search strategy A systematic literature search was conducted from 18 April 2026 to 30 April 2026 in four electronic databases: Scopus, SpringerLink, ScienceDirect, and Google Scholar. These databases were selected to provide broad, multidisciplinary coverage of the literature on conservation agriculture, smallholder farmers, agricultural extension, behavioural change, adoption, and climate resilience. Although CABI Abstracts would have provided additional coverage of agricultural literature, access limitations prevented its inclusion; Google Scholar was therefore included to enhance the search's sensitivity and breadth.

A predefined search strategy was applied to each database, with minor adaptations to accommodate differences in database search functions. The search combined terms relating to conservation agriculture, farmers and adoption with terms relating to behavioural change and farmer-support approaches, including training, incentives, nudges, extension, farmer field schools and behavioural interventions. Terms relating to resilience, climate adaptation and adaptive capacity were also incorporated where applicable. Truncation, phrase searching and Boolean operators were used where supported by the respective database.

The database-specific search strings were as follows:

1. Scopus

("conservation agriculture" AND farmer* AND adoption AND (train* OR incentive* OR nudge* OR extension OR behaviour* OR behavior*))

2. SpringerLink

"conservation agriculture" AND farmers AND (training OR incentives OR extension OR behaviour OR behavior) AND adoption

3. ScienceDirect

"conservation agriculture" AND farmers AND adoption AND (training OR incentives OR behaviour OR extension) AND resilience

4. Google Scholar

"smallholder farmers" OR "small-scale farmers" OR "rural farmers" "conservation agriculture" OR CA adoption OR uptake OR implementation "behavior change" OR "behaviour change" OR "behavioural interventions"

The searches were intended to identify empirical studies examining behavioural change approaches associated with the adoption of conservation agriculture among smallholder farmers, including training, extension, incentives, farmer field schools, social learning, and behavioural interventions, as well as evidence on adoption, continued use, resilience, and climate adaptation. Retrieved records were subsequently screened against the predefined eligibility criteria.

Participant or population The review addresses smallholder farmers engaged in crop production, particularly those operating in low-income, resource constrained agricultural contexts in developing countries. Participants include individual smallholder farmers and members of smallholder farming households who are exposed to, consider adopting, adopt, partially adopt, sustain, or discontinue conservation agriculture (CA) practices.

The review includes studies involving farmers who participate in behavioural change and farmer-support approaches aimed at influencing CA adoption. These approaches include farmer field

schools, participatory learning and extension, farmer-to-farmer and peer learning, lead-farmer approaches, demonstration plots, repeated exposure to demonstrations, training, extension services, incentives, and behavioural interventions. Where studies examine farmers collectively, participants include members of farmer groups, cooperatives, or community-based farming groups, provided that the studies report findings relevant to CA adoption or sustained use among smallholder farmers.

The primary population of interest is smallholder farmers. Information concerning other actors, such as extension personnel, lead farmers, community leaders, researchers, government institutions, and development organisations, is considered where their roles directly influence the implementation of behavioural change approaches or the adoption and sustained use of CA. These stakeholders do not, however, constitute the primary participant population of the review.

Intervention The review evaluates behavioural change approaches and farmer-support interventions used to promote the adoption and sustained use of conservation agriculture (CA) among smallholder farmers. Interventions are broadly defined as approaches that aim to influence farmers' knowledge, attitudes, motivation, skills, perceptions, decision-making, social learning, or farming behaviour regarding CA. The interventions examined include farmer field schools, participatory learning and extension, farmer-to-farmer and peer learning, lead-farmer approaches, demonstration plots, repeated exposure to demonstrations, farmer training, agricultural extension services, incentives, and behavioural interventions or nudges, including technology-mediated approaches such as mobile or text-based reminders. These approaches may be implemented individually or in combination and may involve different delivery mechanisms and stakeholder groups.

The review considers interventions intended to influence initial adoption as well as continued use, persistence, intensity, partial adoption, or dis-adoption of CA practices. Particular attention is given to evidence describing the mechanisms through which behavioural change approaches influence farmer decisions and the contextual conditions that enable or constrain sustained adoption, including social networks, peer influence, access to information, financial and input constraints, labour requirements, institutional support, gender and sociocultural factors, and policy conditions.

The review does not evaluate the agronomic effectiveness of individual CA practices in isolation.

Rather, it focuses on the behavioural and farmer-support approaches used to influence farmers' adoption and sustained use of CA, and examines their reported contributions to climate resilience and climate-change adaptation, where such outcomes are assessed in the included studies.

Comparator A specific comparative intervention is not required for inclusion in this review. Given the diversity of behavioural change approaches and study designs represented in the evidence base, eligible studies may include comparisons with usual agricultural extension or advisory services, no-intervention or baseline/pre-intervention conditions, alternative behavioural change approaches, or other forms of farmer support. Studies without a formal comparator are also eligible where they provide empirical evidence on the implementation, influence, persistence, partial adoption, or dis-adoption of conservation agriculture following a behavioural change or farmer-support intervention.

Where a comparator is reported, it is considered in the synthesis to assess differences in adoption or sustained-use outcomes between intervention and comparison conditions. The absence of a comparator does not preclude an otherwise eligible study, as the review aims to synthesise the broader evidence on how behavioural change approaches influence sustained adoption of conservation agriculture rather than to estimate a single comparative treatment effect.

Study designs to be included The review includes empirical quantitative, qualitative, and mixed-methods studies that provide evidence relevant to behavioural change approaches for the adoption of conservation agriculture (CA) among smallholder farmers. Eligible quantitative designs include cross-sectional studies, longitudinal studies, cohort or panel studies, quasi-experimental studies, experimental or intervention studies, and other observational designs where they provide relevant evidence on CA adoption, sustained adoption, behavioural change, barriers, enabling factors, stakeholder roles, or climate-resilience outcome.

Eligibility criteria Studies were eligible for inclusion if they met the following criteria:

Population: Studies involving smallholder farmers or small-scale farming households engaged in crop production, particularly in low income and resource constrained contexts. Studies involving farmer groups, cooperatives, or community-based farming groups were eligible if the findings directly related to smallholder farmers.

Intervention: Studies examining behavioural change approaches or farmer-support interventions intended to promote conservation agriculture (CA) adoption or sustained use. Eligible approaches included farmer field schools, participatory learning and extension, farmer-to-farmer and peer learning, lead-farmer approaches, demonstration plots, repeated exposure to demonstrations, farmer training, extension services, incentives, and behavioural interventions or nudges.

Outcomes: Studies were eligible where they reported evidence on CA adoption, sustained adoption, continued use, intensity of adoption, partial adoption, persistence, or dis-adoption, or examined behavioural, social, economic, institutional, or contextual factors influencing these outcomes. Studies reporting relationships between CA adoption and climate resilience, climate adaptation, or adaptive capacity were also eligible. **Study design:** Quantitative, qualitative, and mixed-methods empirical studies were included. Eligible designs included observational, cross-sectional, longitudinal, cohort or panel, experimental, quasi-experimental, case study, interview, focus group, and other empirical designs providing relevant evidence.

Publication period: Studies published between 2015 and 2026 were included to capture contemporary evidence on behavioural approaches, CA adoption, and climate-resilience considerations.

Language: Studies published in English were included because this was the language used for the review screening and data extraction.

Geographical scope: The review focused on low income, resource constrained smallholder farming contexts relevant to developing-country settings. Studies were considered where their populations and findings were applicable to the review's focus on smallholder farmers and sustained CA adoption.

Studies were excluded if they focused exclusively on the agronomic or biophysical performance of CA practices without examining adoption, behaviour, farmer decision-making, or relevant contextual factors. Reviews, theoretical or conceptual papers without empirical findings, editorials, commentaries, protocols, conference abstracts without sufficient empirical information, and studies that did not address CA adoption or sustained use were also excluded.

Where a study included multiple agricultural practices or farmer populations, it was included only when findings relating specifically to CA and smallholder farmers could be identified and extracted separately.

Information sources The review used four electronic databases as the primary sources of information: Scopus, SpringerLink, ScienceDirect, and Google Scholar. These databases were selected to provide multidisciplinary coverage of literature relevant to conservation agriculture, smallholder farming, agricultural extension, behavioural change, adoption, and climate resilience.

The searches were conducted between 18 April 2026 and 30 April 2026 using predefined database-specific search strategies. The search strategies were adapted to each database's functionality while maintaining the core concepts of conservation agriculture, farmers, adoption, behavioural change, and farmer-support approaches.

Scopus was used to identify multidisciplinary peer-reviewed research, particularly literature addressing agricultural adoption, behavioural factors, extension and sustainability. SpringerLink and ScienceDirect were searched to identify additional peer-reviewed studies across agricultural, environmental, social science and sustainability research. Google Scholar was included to broaden the search and improve retrieval sensitivity, particularly for relevant empirical studies that may not have been indexed in the other databases.

The reference lists of retrieved eligible studies were considered, where relevant, to identify additional potentially eligible evidence. Only studies meeting the predefined eligibility criteria were included in the final synthesis.

The information sources were selected to provide broad coverage of empirical evidence on behavioural change approaches, sustained adoption of conservation agriculture, stakeholder roles, barriers, enabling factors, and climate resilience among smallholder farmers. CAB Abstracts was not included because access limitations prevented its use.

Main outcome(s) The primary outcome of the review is sustained adoption of conservation agriculture (CA) among smallholder farmers. Sustained adoption refers to the continued use of CA practices following initial exposure or adoption and includes evidence of persistence, continued use, adoption intensity, partial adoption, and disadoption where these outcomes are reported in the included studies.

The review examines whether and how behavioural change approaches contribute to sustained CA adoption and identifies the behavioural, social, economic and institutional conditions associated with continued or discontinued use. Relevant outcomes include changes in adoption status,

duration or persistence of adoption, intensity or number of CA practices adopted, frequency or continued use of practices, and reported disadoption.

Because the included studies use heterogeneous study designs and outcome measures, no single effect measure is specified. Where quantitative studies report comparative effects, the measures reported by the original studies are considered, including odds ratios, risk ratios, regression coefficients, mean differences, percentage-point differences, adoption rates or proportions, as applicable. Qualitative and mixed-methods studies are synthesised according to reported themes and explanations concerning sustained adoption, persistence, partial adoption and dis-adoption.

The timing of outcome assessment is also considered. Evidence is examined according to whether outcomes are assessed at initial adoption, during implementation, across multiple agricultural seasons, or after continued exposure to the intervention, where such information is available. Attention is given to evidence of adoption sustained beyond the initial intervention or exposure period.

Where reported, the review also considers the relationship between sustained CA adoption and climate resilience, climate adaptation or adaptive capacity as a secondary outcome. However, the primary outcome remains sustained CA adoption, consistent with the review's central focus on behavioural change approaches that support continued use of CA among smallholder farmers.

Additional outcome(s) The review considers the following secondary outcomes where they are reported in the included studies:

1. Behavioural outcomes: Changes in farmers' knowledge, awareness, attitudes, motivations, intentions, perceived benefits or risks, social norms, risk preferences, and decision-making related to CA adoption.
2. Adoption-related outcomes: Initial uptake, speed of adoption, adoption intensity, extent or number of CA components adopted, partial adoption, continued use, persistence and dis-adoption.
3. Social and institutional outcomes: The influence of peer networks, social capital, farmer groups, lead farmers, community leaders, extension services, institutional networks, stakeholder engagement and policy or institutional arrangements on CA adoption.
4. Economic and resource-related outcomes: Where reported, the influence of access to credit, inputs, equipment, labour, extension support and other livelihood or resource constraints on adoption and sustained use of CA.

5. Climate-resilience outcomes: Reported changes or associations between CA adoption and climate adaptation, adaptive capacity, resilience to climate variability, or farmers' ability to respond to climate-related challenges.

6. Implementation-related outcomes: Where reported, evidence concerning the delivery, reach, acceptability, participation, exposure, intensity and continuity of behavioural change approaches, including farmer training, demonstrations, farmer field schools, participatory learning, peer learning, extension and behavioural nudges.

Because the included studies use diverse methodologies and outcome measures, secondary outcomes are synthesised according to the measures and findings reported by individual studies rather than using a single predefined effect measure. These outcomes are used to explain how behavioural change approaches influence sustained CA adoption and the conditions under which adoption is maintained or discontinued.

Data management All records retrieved from electronic database searches were systematically managed throughout the review process. Search results from Scopus, SpringerLink, ScienceDirect, and Google Scholar were recorded and organised to facilitate screening, identification and removal of duplicate records, and tracking of studies through the review process.

A structured data-extraction matrix was used to manage information from the included studies. The extraction matrix captured study identification and publication details, geographical and contextual characteristics, study design and methodology, theoretical or conceptual frameworks, behavioural change approaches, stakeholder roles, barriers, enabling factors, adoption and sustained-adoption outcomes, climate-resilience outcomes, key findings, and quality appraisal results.

Records were screened against the predefined eligibility criteria, and the decisions made during title/abstract and full-text screening were recorded. Data extracted from eligible studies were checked for completeness and consistency before synthesis. Quality appraisal information was also recorded alongside the extracted study data to support interpretation of the evidence.

The review maintained an audit trail linking retrieved records to screened studies and ultimately to the studies included in the synthesis. The final dataset comprised the 50 studies included in the review, with extracted information organised in a structured evidence matrix. This process supported transparent record management, consistent data extraction, and traceability of the evidence used in the narrative synthesis.

Quality assessment / Risk of bias analysis The methodological quality of the included primary studies was assessed using the Mixed Methods Appraisal Tool (MMAT), version 2018 (Hong et al., 2018). The MMAT was selected because the review includes qualitative, quantitative and mixed-methods empirical studies, allowing the methodological quality of different study designs to be assessed using a common appraisal framework.

Each included study was assessed according to the MMAT criteria applicable to its study design. The assessment considered the appropriateness of the study methodology, sampling or participant selection, measurement or data-collection methods, analysis, and the extent to which the methods adequately addressed the research question. For mixed-methods studies, the appraisal also considered the appropriateness of integrating qualitative and quantitative components.

Quality appraisal findings were recorded in the structured data-extraction matrix and were considered during interpretation and synthesis of the evidence. The appraisal was used to identify methodological strengths and limitations across the evidence base and to inform the assessment of confidence in the review findings. Studies were not excluded solely on methodological quality when they otherwise met the predefined eligibility criteria; instead, their methodological limitations were considered in interpreting the findings.

Strategy of data synthesis The extracted data were analysed using a narrative synthesis approach due to substantial heterogeneity among the included studies in study designs, populations, behavioural change approaches, contextual conditions, outcome measures, and reported findings. Quantitative, qualitative and mixed-methods evidence was therefore not statistically pooled into a single meta-analysis.

The analysis involved systematically organising and comparing findings across the included studies according to the main concepts of the review: behavioural change approaches, mechanisms of behavioural influence, stakeholder roles, barriers, enabling factors, sustained adoption of conservation agriculture, disadoption, and climate resilience. Studies were grouped according to the type of behavioural change approach used and the outcomes reported. Patterns of convergence, divergence and contextual variation across studies were examined. For quantitative evidence, reported measures of adoption and behavioural outcomes were described and compared using the measures reported in the original studies. These included

adoption rates or proportions, adoption intensity, persistence, dis-adoption and reported associations between explanatory factors and adoption outcomes. Where studies reported effect estimates, these were interpreted using the measures provided by the original studies rather than converted into a common effect measure.

Qualitative evidence was synthesised thematically to identify recurring explanations of farmers' behaviour, including perceptions, motivations, social influence, learning processes, risk considerations, stakeholder interactions, resource constraints and institutional conditions. Findings from quantitative and qualitative studies were then integrated to develop a broader explanation of how behavioural change approaches interact with contextual conditions to influence sustained CA adoption.

The synthesis also examined differences across geographical and socioeconomic contexts to identify factors that may explain variation in intervention outcomes. Attention was given to evidence concerning continued adoption across multiple seasons, persistence after intervention exposure, partial adoption and dis-adoption, rather than treating adoption as a single-time or binary outcome.

The findings were subsequently organised into overarching themes and relationships between themes. This synthesis was used to identify areas of consistency and disagreement in the evidence, assess the strengths and limitations of the available evidence, and identify gaps requiring further research. Where reported in the primary studies, the relationship between sustained CA adoption and climate resilience, climate adaptation or adaptive capacity was also examined.

Given the heterogeneity of the evidence, the analysis prioritised the interpretation of patterns and mechanisms across studies rather than estimating a pooled intervention effect.

Subgroup analysis Where sufficient evidence was available, subgroup analyses were conducted to examine whether the influence of behavioural change approaches on sustained adoption of conservation agriculture (CA) varied across types of behavioural interventions, geographical contexts, study populations, and contextual conditions.

The analysis considered differences among major intervention categories, including farmer field schools and participatory learning, farmer-to-farmer and peer-learning approaches, lead-farmer models, demonstration-based approaches, conventional extension and training, and behavioural nudges or technology-mediated interventions. Where sufficient evidence was

available, findings were also compared according to whether interventions involved single or repeated exposure and whether they were implemented independently or in combination.

Geographical and contextual differences were examined by comparing evidence across countries and regions, particularly African and South Asian smallholder farming contexts represented in the included studies. Where data permitted, differences associated with resource availability, institutional support, access to finance and inputs, social networks, gender and sociocultural conditions were also considered.

Subgroup analysis further considered differences in the stage of adoption examined, including initial adoption, sustained adoption, partial adoption, adoption intensity, and disadoption, as well as differences between studies that assessed outcomes over a single agricultural season and those that examined outcomes across multiple seasons or longer periods.

Because the evidence was heterogeneous and not all subgroups contained sufficient studies for meaningful comparison, subgroup findings were interpreted descriptively and thematically rather than through formal statistical subgroup tests. Subgroup comparisons were undertaken only where sufficient and comparable evidence was available, and findings were interpreted cautiously to distinguish potential differences in intervention effects from differences attributable to study design, context or population.

Sensitivity analysis Sensitivity analysis was conducted to assess the review findings for differences in methodological quality and study characteristics. Attention was given to studies with lower methodological quality, studies with substantial methodological limitations identified through the MMAT assessment, and studies whose findings differed substantially from the broader evidence base.

The synthesis was examined to determine whether the overall patterns and conclusions regarding behavioural change approaches and sustained adoption of conservation agriculture (CA) were substantially altered when findings from studies with greater methodological limitations were considered separately or given less interpretive weight. Sensitivity was also considered in relation to differences in study design, outcome measurement, and follow-up duration, particularly where these differences could influence conclusions about sustained adoption.

Because the review used a narrative synthesis rather than statistical meta-analysis, sensitivity analysis was conducted qualitatively rather than through statistical leave-one-out or pooled-effect

analyses. The findings were considered robust when the main themes and interpretations remained consistent across studies with different methodological quality and designs. Where conclusions depended heavily on a small number of studies or on studies with important methodological limitations, this was explicitly acknowledged when interpreting the evidence.

Language restriction The review was restricted to English-language studies because screening, appraisal and synthesis were conducted in English. This restriction may have introduced language bias.

Country(ies) involved Zambia.

Other relevant information The review followed the PRISMA 2020 reporting guidance. The methodological quality of included studies was assessed using the Mixed Methods Appraisal Tool (MMAT), version 2018. Given the heterogeneity of study designs, interventions and outcomes, findings were synthesised using a narrative synthesis approach rather than statistical meta-analysis. The review included 50 empirical studies published between 2015 and 2026 and examined behavioural change approaches, stakeholder roles, barriers, enabling factors, sustained adoption of conservation agriculture, and climate resilience among smallholder farmers.

Keywords Conservation agriculture; Behavioural change; Smallholder farmers; Sustained adoption; Agricultural extension; Farmer field schools; Climate resilience; Dis-adoption.

Dissemination plans The findings of the systematic review will be disseminated through publication in a peer-reviewed international journal focusing on conservation agriculture, agricultural sustainability, climate resilience, agricultural extension, or behavioural change. The findings will also be communicated through academic conferences, research seminars and relevant professional and policy forums.

Key findings will be presented in an accessible format for policymakers, agricultural extension practitioners, development organisations and other stakeholders involved in promoting conservation agriculture and climate-resilient smallholder farming. Where appropriate, policy and practice-oriented summaries will be developed to highlight evidence on effective behavioural change approaches, barriers, enabling factors, and conditions that support sustained adoption.

The review findings will also contribute to the researcher's doctoral research and related

academic outputs, supporting further research and evidence-informed interventions to strengthen sustained adoption of conservation agriculture and climate resilience among smallholder farmers.

Contributions of each author

Author 1 - Laura Nkhuwa - i conceptualised and developed the systematic review, formulated and refined the review question, developed the objectives and eligibility criteria, designed the search strategy, and coordinated the literature search and screening process. Led the data extraction and synthesis, conducted the methodological quality assessment, interpreted the findings, and developed the conceptual framework,.

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Author 2 - Tamara Chansa-Kabali - My research principal supervisor provided overall academic and methodological supervision throughout the review. She reviewed and provided critical guidance on the review question, objectives, methodological approach, eligibility criteria, interpretation of findings and structure of the manuscript. She provided feedback on successive drafts of the review.

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Author 3 - Progress Nyanga - My co-supervisor provided academic and methodological guidance on the systematic review process, including the review scope, methodology, interpretation of findings and presentation of the evidence. He reviewed sections of the manuscript and provided feedback to improve the clarity, methodological rigour and scholarly contribution of the review.

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Author 4 - Arthur Milandile - Supported data extraction from the eligible studies. This included extracting relevant information according to the predefined data-extraction framework and recording study characteristics, behavioural change approaches, contextual factors and reported outcomes. The author also contributed to checking the consistency and completeness of extracted information.

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Author 5 - Lupupa Kachenga - Supported data extraction and verification. This included extracting relevant information from eligible studies using the predefined extraction framework, checking extracted information for completeness and consistency, and supporting the identification of discrepancies in the extracted evidence.

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