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ADVANCING NATURAL FARMING: A SYSTEMATICAL LITERATURE REVIEW OF NATURAL FARMING PRACTICES IN INDIA

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ABSTRACT----------
The agricultural sector captures a key position and is the backbone of the Indian economy. This systematic literature review (SLR) investigates the efficacy of natural farming practices, which is known as Zero Budget Natural Farming (ZBNF), in addressing sustainability challenges in Indian agriculture. Analyzing 21 finalized papers spanning 2015 to 2024, the review explores ZBNF's impact on farmer incomes, crop yields, and soil health. Findings suggest that ZBNF reduces production costs, enhances soil fertility, and mitigates adverse environmental effects. However, challenges such as limited resources, pest management, and technological constraints hinder widespread adoption. Graphical analyses illustrate increasing research output and India's prominence in the field. Overall, the review emphasizes the potential of natural farming to promote socio-ecological resilience and calls for further research to address implementation challenges foster policy support for sustainable agriculture, and encourage farmers to consider it lifestyle.

KEYWORDS: *natural farming, sustainability, India, Challenges.----------*

INTRODUCTION

The agricultural sector captures a key position and is the backbone of the Indian economy. (Maheshwari & Tandon, 1959). The Green Revolution has led to India becoming a food surplus nation, but it has also led to negative effects such as unremunerative agriculture, stagnant crop output, unstable market conditions, and climate change consequences. Farmers face health risks and increased debt due to the rising cost of cultivation. Natural Farming (NF) is considered a useful strategy to overcome these issues. Andhra Pradesh farmers are using ghanajeevamritha, a solid version of jeevamritha, a liquid mixture of microbial inoculants (R. Kumar et al., 2023). Natural farming, sometimes known as organic farming, is being pushed as a beneficial sustainable agricultural method (Sulok et al., 2021).

LITERATURE REVIEW

In Andhra Pradesh, Zero Budget Natural Farming (ZBNF) is now a prioritized agricultural technique for an extension. It highlights the application of regenerative agricultural methods and specified chemical-free inputs as a comprehensive strategy for socio-ecological resilience (Walker et al., 2021). The broader context of zero-budget techniques, aiming to reduce farmers' direct costs while promoting environmentally friendly practices, is reflected in the national initiative known as Zero Budget Natural Farming (ZBNF) (Bharucha et al., 2020). This initiative, particularly prominent in Andhra Pradesh, showcases statistically significant changes in farmer incomes and yields between ZBNF and non-ZBNF crops (Bharucha et al., 2020).

The rising global demand for organic foods has led the Indian government to support organic agriculture through the Paramparagat Krishi Vikas Yojana (PKVY) since 2015. While there are concerns about the economic surplus model predicting declines in producer and consumer surplus due to lower crop yields, the transition to organic farming is seen as a potential solution, particularly in rainfed, hilly, and tribal regions (Reddy et al., 2022).

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Zero Budget Natural Farming (ZBNF) in India focuses on reducing direct costs for farmers while enhancing yields and farm health through locally produced, non-synthetic inputs. Challenges such as scarce raw supplies, weed and pest control, technology limitations, and the need for convergence are recognized, indicating the complexities of implementing ZBNF (S. Kumar et al., 2023).

While the concept of natural farming or organic farming gains momentum globally, the use of premium soil conditioners from agricultural wastes becomes a focal point to improve and maintain soil health and crop yield (Sulok et al., 2021). However, there remains a need for statistically assessed data to substantiate claims of ZBNF's yield advantages and to provide a mechanistic explanation for them (Duddigan et al., 2023).

In the context of conservation techniques in rice-growing regions, research on natural farming in India explores methods to preserve agricultural biodiversity without relying on external inputs. While there are variations in grain yields, economic measures often favor conventional tillage over alternative techniques (Saini et al., 2022).

A study conducted in Purulia, West Bengal, assesses the economic viability of Zero Budget Natural Farming (ZBNF) in comparison to chemical farming, demonstrating its potential to reduce production costs and increase farmer income. However, long-term sustainability challenges influenced by agroclimatic conditions and socioeconomic factors pose considerations for further adoption (Koner & Laha, 2020).

Despite the potential of Zero Budget Natural Farming (ZBNF) in enhancing agricultural sustainability in India, concerns exist about its effectiveness compared to other farming methods. The implementation of ZBNF in small-scale farming systems did not immediately result in reductions in crop yields, emphasizing the need for tailored solutions based on different agroclimatic zones (Duddigan et al., 2022).

Natural farming, particularly Zero Budget Natural Farming (ZBNF), has been advocated as an environmentally friendly agricultural technique. It significantly influences microbial communities and soil characteristics, demonstrating its impact on sustainable farming systems (Liao et al., 2019).

An exploration of the Indian movement known as "Zero Budget Natural Farming" reveals a shift towards small-scale farming grounded in Indian agroecological concepts. This movement challenges standard agronomic approaches and aims to coexist with bacteria, mycorrhizae, animals, and humans in creating a different rural environment (Münster, 2018).

A study examining the impact of urine-based Jeevamrit and cow dung in Zero Budget Natural Farming (ZBNF) showcases notable improvements in soil qualities and a doubled cost-benefit ratio in cropping systems beyond wheat and rice. This proof of concept emphasizes the potential of Jeevamrit in enhancing soil health (Saharan et al., 2023).

Cotton, a globally significant cash crop, is evaluated in terms of sustainability and economics through a comparison of integrated and organic farming to natural farming. The study aims to understand how natural farming affects cotton yield and economics, considering the potential benefits of this economical and environmentally beneficial practice (Monicaa et al., 2023).

In the pursuit of sustainable agriculture, this study presents an integrative methodological approach to analyze Precision Farming (PF) and Zero Budget Natural Farming (ZBNF). Machine learning algorithms are applied to assess the productivity of crops in PF, concluding that ZBNF is a more profitable and cost-effective option, with positive impacts on soil micronutrients and microbial diversity (Ghuriani et al., 2023).

OBJECTIVE

This article aims to provide a comprehensive analysis of the literature on natural farming practices in India, with a focus on Zero Budget Natural Farming (ZBNF) and its implications for agricultural sustainability. By synthesizing the findings from a systematic literature review (SLR), this study seeks to evaluate the effectiveness, challenges, and potential of natural farming techniques in addressing issues such as unremunerative agriculture, stagnant crop output, market instability, and climate change consequences.

METHODOLOGY

1. The systematic literature review (SLR) encompassed a total of 74 documents.
2. The data retrieval for the review was conducted on February 3, 2024.
3. The SLR covered publications spanning the years 2015 to 2024.

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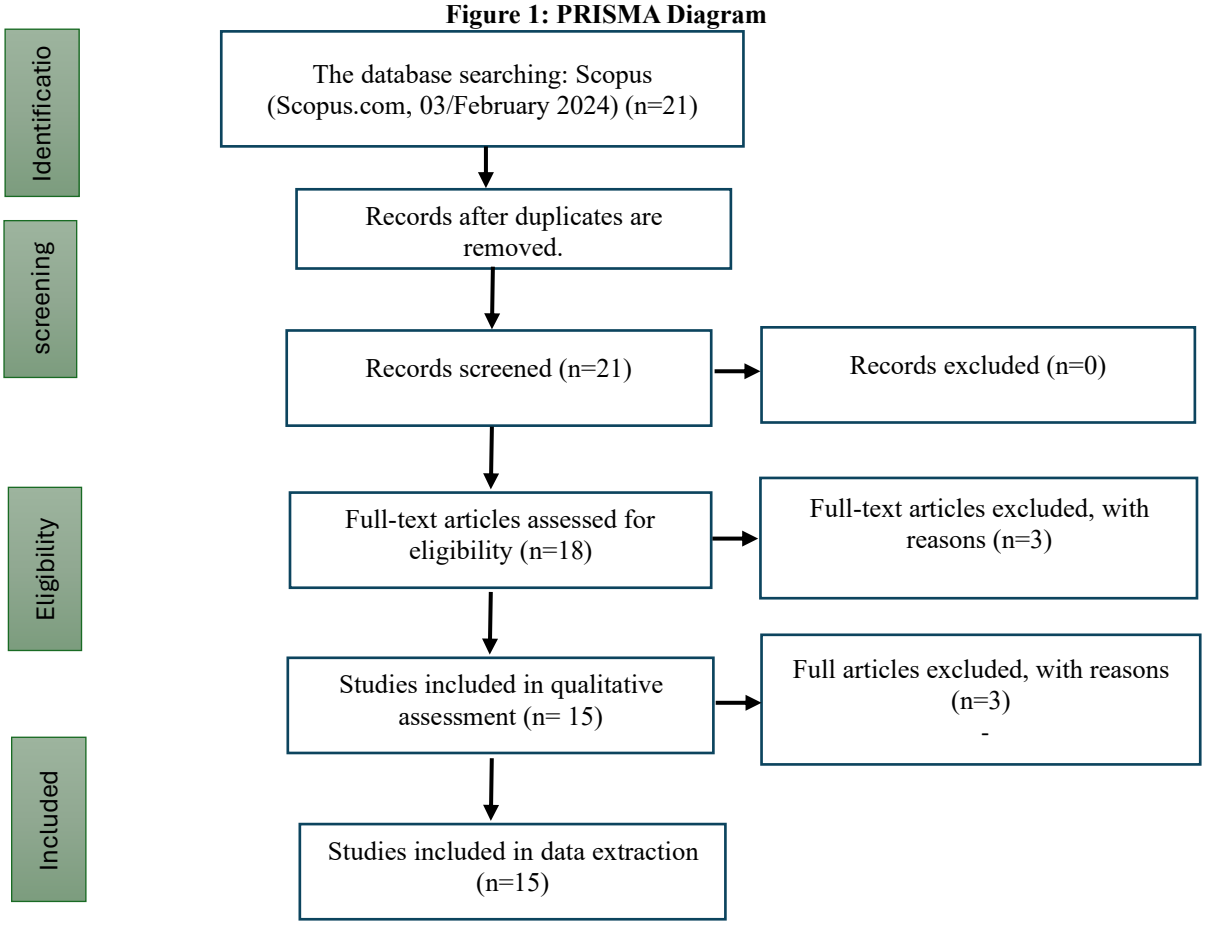
4. The primary document type considered in the review was articles.
5. All documents included in the review had reached the final publication stage.
6. The subject areas covered in the SLR included agricultural and biological sciences, social sciences, and environmental science.
7. The language of the documents analyzed in the review was English.
8. The systematic literature review ultimately included 21 finalized papers in its analysis.

Query string: Scopus database query string is as follows (Dawit Negussie Tolossa1, n.d.):
TITLE-ABS-KEY(Practice* AND of Natural-Farming) AND PUBYEAR > 2014 AND PUBYEAR < 2024 AND (LIMIT-TO (OA,"all")) AND (LIMIT-TO (SUBJAREA,"SOCI") OR LIMIT-TO (SUBJAREA,"AGRI") OR LIMIT-TO (SUBJAREA,"ENVI")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (PUBSTAGE,"final")) AND (LIMIT-TO (LANGUAGE,"English")) this Scopus query aims to find recent, peer-reviewed articles related to the practice of natural farming, with a focus on open access content in the fields of social sciences, agriculture, and environmental sciences. The search is restricted to articles published in English between 2015 and 2023

Figure 1: PRISMA Diagram



The **PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** flow diagram is a visual representation that outlines the systematic review process. It serves as a guide for researchers conducting systematic reviews or meta-analyses to ensure transparency and rigor in their work.

Identification: The process begins with **database searching**, where relevant databases (such as Scopus) are queried to identify potential studies. In this specific case, **21 records** were initially retrieved.

Duplicate records are then removed to avoid redundancy and maintain data integrity.

Screening: All **21 records** undergo a screening phase. During this step, researchers assess the relevance of each record based on predefined inclusion and exclusion criteria.

Interestingly, **no exclusions** occurred at this stage, implying that all records passed the initial screening.

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Eligibility Assessment: 18 full-text articles are meticulously evaluated for eligibility. Researchers delve into the content of these articles to determine whether they meet specific criteria.
Unfortunately, **3 articles** did not meet the eligibility requirements and were excluded. However, the reasons for their exclusion are not explicitly stated in the diagram.

Inclusion: 15 studies successfully passed the eligibility assessment and were included in the subsequent qualitative assessment.

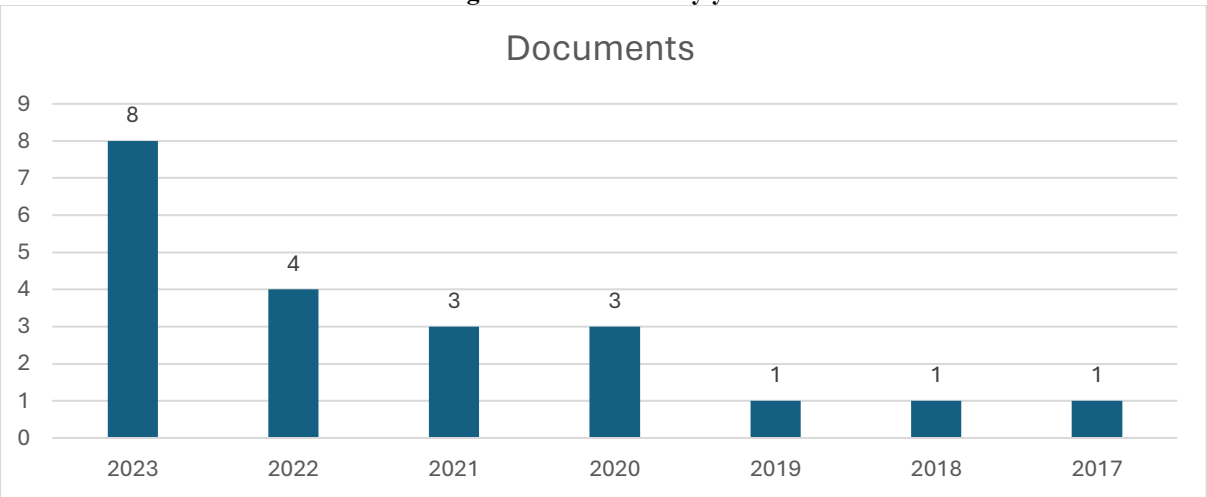
These same **15 studies** were also considered for data extraction, which is a critical step in synthesizing evidence. The PRISMA flow diagram provides a concise overview of the systematic review journey—from initial identification to final inclusion of relevant studies. Researchers rely on this framework to maintain transparency, minimize bias, and enhance the quality of their systematic reviews.

DISCUSSION

Analysis: The literature review reveals a growing interest in natural farming as a sustainable agricultural method, particularly in the context of India's agricultural landscape. Studies underscore the significant impacts of ZBNF on farmer incomes, crop yields, soil health, and environmental sustainability. Notably, the adoption of ZBNF has shown promising results in reducing production costs, enhancing soil fertility, and mitigating the adverse effects of conventional farming practices. However, challenges such as limited raw supplies, weed and pest management, technological constraints, and the need for convergence pose obstacles to widespread adoption.

The PRISMA flow diagram provides insights into the systematic review process, highlighting the rigorous methodology employed in identifying, screening, and selecting relevant studies. The graphical representations of document counts by year, country, and subject offer valuable insights into the trends, geographical distribution, and thematic focus of research on natural farming practices. The analysis of document counts by year indicates a notable increase in research output in recent years, reflecting a growing interest and emphasis on sustainable agriculture and natural farming techniques.

Figure 2: Document by year



The graph illustrates the document count for each year, and several key observations can be drawn from the data. In the year 2023, the most prominent feature is the tallest blue bar, representing 8 documents. This peak suggests a substantial increase in document production compared to preceding years, indicating a noteworthy trend. Moving to 2022, the subsequent bar depicts 4 documents, not reaching the height of 2023 but still reflecting a considerable volume. For both 2021 and 2020, the blue bars are shorter, each representing 3 documents. The consistent count across these two years suggests a stable trend in document production. In the years 2019, 2018, and 2017, the blue bars are very short, signifying only 1 document per year, indicating minimal document production during these periods.

In summary, the graph unveils an upward trajectory in document creation, with a distinctive surge in 2023. This trend may pique the interest of researchers and analysts, prompting exploration into the underlying reasons behind the fluctuations in document output over the years.

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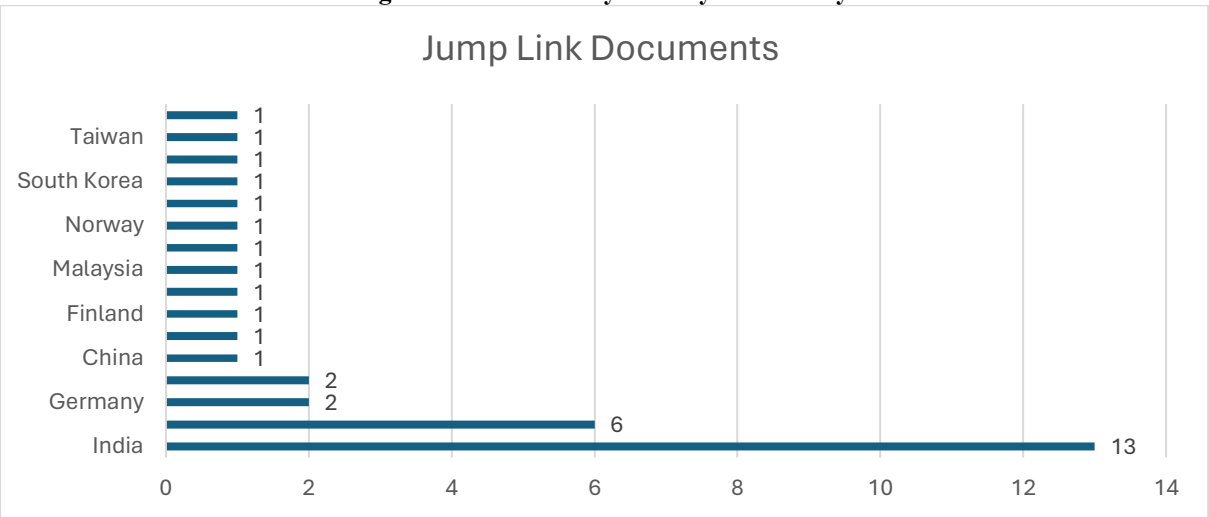
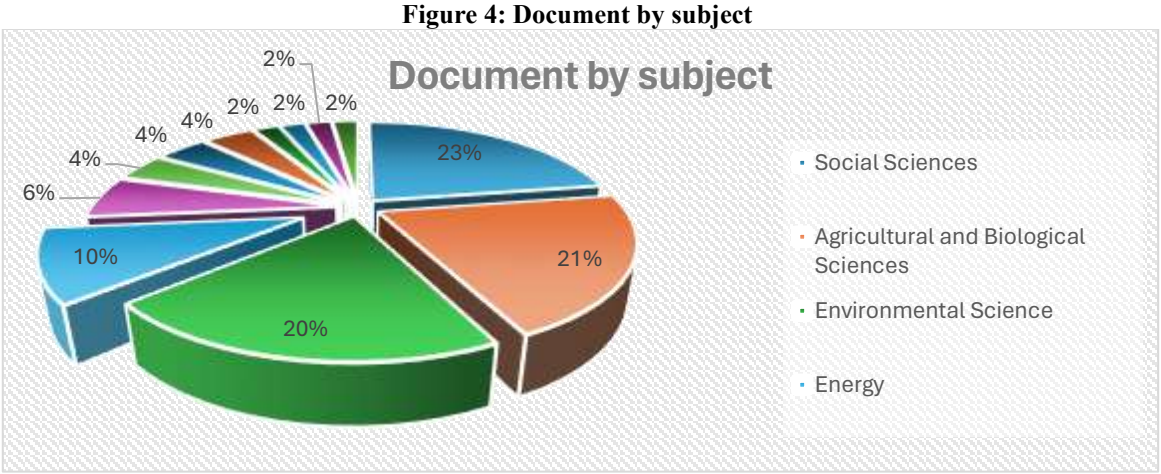
Figure 3: Document by country or territory



The graph provides a comparison of jump link documents associated with eight different countries: Taiwan, South Korea, Norway, Malaysia, Finland, China, Germany, and India. Each of the countries—Taiwan, South Korea, Norway, Malaysia, Finland, and China—has one jump link document. Germany stands out with two jump link documents. However, India leads the group with a total of 13 jump link documents. This discrepancy in numbers highlights India's substantial activity or relevance in this context. It is essential to note that jump link documents may hold significant importance in various domains. Therefore, conducting further investigation into the content and significance of these documents could offer valuable insights.

Figure 4: Document by subject



This chart serves as a visual representation illustrating the distribution of documents across various subjects. The key points extracted from the graph are as follows:

In terms of percentages, Agricultural and Biological Sciences dominate with the largest segment, constituting 23% of the documents, covering topics related to agriculture, biology, and life sciences. Following closely is Biochemistry, Genetics, and Molecular Biology, representing 21% of the documents and encompassing research in those respective fields. Computer Science holds a substantial portion, occupying 20% of the pie, focusing on studies related to computer technology, algorithms, and programming. Energy, a smaller segment, makes up 10% of the documents, likely delving into energy-related research. Environmental Science comprises 6% of the pie, concentrating on environmental studies and sustainability. The Social Sciences category, divided into four segments, each represents 2% and covers various disciplines such as sociology, psychology, economics, and political science.

In summary, the pie chart offers a comprehensive overview of document distribution across subjects, allowing for a comparison of the relative magnitudes of each subject area by assessing the sizes of the respective slices. The text also emphasizes the effectiveness of pie charts in comparing parts to the whole, suggests considerations when interpreting multiple pie charts, and highlights the limitations of using pie charts for more complex data

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arrangements. It underscores the utility of pie charts for understanding proportions within a dataset while acknowledging their limitations.

RESULT

The systematic literature review underscores the significance of natural farming, particularly ZBNF, as a viable and sustainable agricultural approach in India. While challenges persist, the evidence suggests that natural farming practices have the potential to address key issues pursuing conventional agriculture, promote socio-ecological resilience, and contribute to food security and environmental sustainability. Future research should focus on addressing the identified challenges, expanding the scope of natural farming initiatives, and fostering policy support to facilitate the widespread adoption of sustainable agricultural practices in India and beyond.

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