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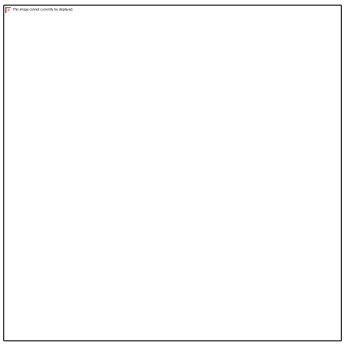

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COURSE CODE : DG470

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AN INVESTIGATION ON THE EFFECTIVENESS OF PFUMVUDZA AS A DROUGHT RESILIENT STRATEGY IN ACHIEVING THE SUSTAINABLE DEVELOPMENT GOAL (SDG) OF ZERO HUNGER. THE EXPERIENCES OF RURAL COMMUNITIES IN WARD 4, ZVIMBA DISTRICT.

A DISSERTATION SUBMITTED TO THE GEOGRAPHY DEPARTMENT AS A REQUIREMENT IN PARTIAL FULFILLMENT IN PARTIAL FULFILLMENT OF

THE BACHELOR OF SCIENCE HONOURS DEGREE IN DEVELOPMENT STUDIES

APPROVAL FORM

The undersigned confirm that they have read and recommended the project titled: investigating the effectiveness of Pfumvudza as a drought resilient strategy in achieving the Sustainable Development Goal 2 (Zero hunger) case of ward 4, Zvimba district, Zimbabwe. This is a partial fulfillment of the requirements of the Bachelor of Science Honours Degree in Development Studies at Bindura University of Science Education. The project was submitted by Qitani Vimbai, registration number B212671B.

Dr Bowora (Supervisor) Signature  Date 17/06/25.

Chairman's signature  Date…17/06/2

External Examiner's signature…… Date…17/06/25

DEDICATION

I dedicate this dissertation to my late mother Maria Tawonameso (MHSRIP) whose prayers and sacrifices moulded me enough to keep me during the journey of the degree. I also dedicate this project to my big brothers who have made this degree possible through their financial support, may God bless them abundantly.

ACKNOWLEDGEMENTS

I would like to acknowledge the Almighty, who has seen me through this journey and made it possible. Secondly I acknowledge my supervisor Dr Bowora for his guidance and patience during the course. I am also grateful to the authorities of Zvimba district, from the DDC's office for granting me permission to conduct research in the area. Last but not least I thank my husband whose emotional support and financials has been vital during the hard times in my research.

DECLARATION

I hereby declare that the research project entitled "Investigating the effectiveness of Pfumvudza as a drought resilient strategy in achieving the SDG 2 –Zero Hunger, case of ward 4, Zvimba district" submitted to Bindura University of Science Education, Faculty of Science and Engineering, Department of Sustainable Development, is a record of an original work done by me under the guidance and supervision of Dr Bowora. This work is submitted in partial fulfilment of the requirements for the award of a Bachelor of Science Honours Degree in Development Studies. The results embodied in this research have not been submitted to any University or Institution for the award of any degree or diploma.

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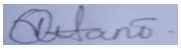
Signature :  : Date:17 June 2025

ABSTRACT

The aim of the study was to investigate the effectiveness of Pfumvudza in achieving zero hunger in ward 4, Zvimba District, Zimbabwe. The research involved small holder farmers, agritex officers and local authorities who provides information on the role of Pfumvudza and its effectiveness in achieving food security sustainably. The study employed a case study design. The research adopted a mixed approach where both qualitative and quantitative data are collected simultaneously but analysed separately for interpretation. Questionnaires and key informant interviews were the instruments used to gather data for analysis. From the research, amongst the characteristics of Pfumvudza findings show that the initiative farmers slightly agree that the initiative is generally labor intensive with a mean of 3.8 rated on the Likert scale and below for other characteristics like need for training and that it works better in high rainfall areas than dry regions of Zimbabwe. Respondents showed that livestock compete with the crops for mulching and that the initiative is labor intensive especially with younger population migrating to urban areas. The research also showed with a mean of 4.5 rated using the Likert scale that farmers strongly agreed that Pfumvudza has many advantages including improving maize yields significantly, improving household food security for adopting farmers and that it requires less labour than conventional tillage. The findings were supported by the views from farmers in their own words expressing gratitude for its trapping of moisture and reduced labour and reduced reliance on relief grain which is sustainability. Challenges were also noted which included the long time taken by Pfumvudza to materialise and female headed households facing difficulties in adopting Pfumvudza due to its labor demands. Strategies recommended for improving Pfumvudza to farmers include community based labor-sharing initiatives, adapted training approaches and localised input support system.

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CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

The study investigates the adoption and implementation of Pfumvudza as a climate-smart agricultural strategy and its effectiveness in contributing to the achievement of Sustainable Development Goal (SDG) 2 - Zero Hunger in Ward 4 of Zvimba District, Zimbabwe. The study emerges against a backdrop of increasing climate variability and chronic food insecurity in Zimbabwe's smallholder farming communities, where traditional farming methods have become increasingly vulnerable to drought conditions. Pfumvudza, introduced nationally in 2020 as a conservation agriculture initiative, represents the government's flagship response to these challenges, yet its actual impact on household food security remains under-researched at the local level. Chapter 1 systematically introduced the research by first presenting the study's background and problem statement, then detailing its objectives, assumptions, scope, and limitations. It concludes by defining key terms and outlining the chapter structure.

1.2 BACKGROUND TO THE STUDY

Globally, conservation agriculture has been widely adopted as a sustainable farming approach to combat soil degradation and enhance food security. The practice originated in response to the 1930s Dust Bowl crisis in the United States, where devastating soil erosion forced farmers to adopt reduced tillage and crop residue retention methods. Since then, conservation agriculture principles have been successfully implemented across various regions with differing climatic conditions. In Europe, countries like Spain, France, and Germany have integrated conservation agriculture into their farming systems with notable results. Spain, for instance, reported 20-30% yield increases in drought-prone regions through minimal soil disturbance and permanent soil cover. France has seen improved water retention and reduced fertilizer requirements, while Germany's adoption of conservation agriculture contributed to a 50% reduction in soil erosion in some areas. Beyond Europe, nations like Brazil and Argentina have become global leaders in conservation agriculture adoption, with Brazil now practicing it on over 50% of its cropland. These success stories demonstrate the global potential of conservation agriculture, though implementation challenges vary significantly across different agricultural systems and policy environments.

In an African context, conservation agriculture has followed a more complex adoption pathway since its initial introduction in the 1970s. The continent's diverse agroecological zones and farming

systems have produced mixed results in different regions. East Africa presents several notable examples, with Kenya implementing conservation agriculture in its dryland areas through projects supported by the World Bank and FAO. Tanzania has seen promising results in the Lake Zone, where farmers combining conservation agriculture with improved seed varieties achieved maize yield increases of up to 40%. In West Africa, Senegal's Groundnut Basin has become a conservation agriculture success story, where the practice has helped rehabilitate degraded soils and improve water infiltration. Ghana has also reported positive outcomes in its northern regions, particularly with maize-soybean rotations under conservation agriculture systems. Southern Africa presents perhaps the most varied experiences, with countries like Mozambique showing strong adoption rates in certain provinces while struggling with implementation challenges in others. These regional differences highlight how conservation agriculture's effectiveness in Africa depends heavily on local adaptations and support systems.

Sub-Saharan countries face particularly acute challenges in implementing conservation agriculture due to climate variability and resource constraints. The Southern African Development Community (SADC) region, encompassing nations like Malawi, Zambia, and Zimbabwe, has been a focal point for conservation agriculture initiatives due to recurring droughts and food insecurity. Malawi's experience with conservation agriculture dates back to 2004 through a CIMMYT-led program that initially showed promise but faced adoption barriers due to competing uses for crop residues as livestock feed. Zambia presents an interesting case where conservation agriculture adoption has been relatively successful among medium-scale farmers but remains limited among resource-poor smallholders. Namibia has experimented with conservation agriculture in its northern communal areas, though results have been mixed due to erratic rainfall patterns. Botswana's recent efforts to promote conservation agriculture in its drought-prone regions demonstrate the growing recognition of its potential, though challenges remain in scaling up adoption. These varied experiences across the subcontinent underscore the need for context-specific approaches to conservation agriculture implementation.

In the case of Zimbabwe, the agricultural landscape has undergone significant transformation since the introduction of Pfumvudza in 2020 as the government's flagship conservation agriculture program. The program's implementation has varied across the country's diverse agroecological regions, with notable differences between high-potential areas like Mashonaland and more

drought-prone regions like Matabeleland. In Mashonaland East, Pfumvudza has shown particularly promising results, with some farmers reporting maize yields increasing from 0.5 metric tons per hectare to over 2.5 metric tons per hectare. Masvingo Province has seen more mixed outcomes, where successful implementation in some areas contrasts with challenges related to termite damage to mulch in others. Manicaland's high rainfall areas have demonstrated how Pfumvudza can be adapted to different conditions, with farmers successfully integrating legumes into their cropping systems. The Midlands Province presents an interesting case where Pfumvudza has helped mitigate mid-season dry spells, though some farmers struggle with the labor requirements. These regional variations highlight both the potential and the challenges of scaling up Pfumvudza across Zimbabwe's diverse farming systems.

In Zvimba District, Ward 4 presents a microcosm of both the opportunities and challenges associated with Pfumvudza implementation. The ward's agroecological conditions, typical of Zimbabwe's highveld region, make it suitable for conservation agriculture approaches, yet specific local factors influence outcomes. Preliminary observations indicate that farmers with access to timely inputs and extension support have generally reported improved yields and better moisture retention in their fields. However, challenges such as limited access to quality mulch materials due to communal grazing arrangements and the labour-intensive nature of proper basin preparation persist. The ward's proximity to urban markets in Chegutu and Harare creates additional dynamics, with some farmers prioritizing market crops over staple food production. Local institutions like farmer groups and extension services play a crucial role in facilitating knowledge sharing and input access, though their capacity varies across the ward. These factors combine to create a complex implementation environment where Pfumvudza's effectiveness depends on multiple interacting variables, making Ward 4 an important case study for understanding the program's potential to contribute to zero hunger goals at the local level. Thus, against this background, the study sought to investigate the effectiveness of Pfumvudza as a drought resilient strategy in achieving the Sustainable Development Goal (SDG) of zero hunger, the experiences of rural communities in Ward 4, Zvimba District.

1.3 STATEMENT OF THE PROBLEM

Climate change-induced drought has severely impacted Ward 4 of Zvimba District, where over 75% of households depend on rain-fed subsistence farming (ZimStat, 2022). The area has experienced consecutive failed rainy seasons since 2018, with rainfall patterns becoming increasingly erratic and unpredictable. Local agricultural extension reports indicate maize yields in the ward have declined by approximately 40% over the past five years, forcing many families to rely on food aid (DAE Zvimba, 2023). This crisis has manifested in Ward 4 through visible malnutrition cases at local clinics, increased school dropouts as children help with household food procurement, and rising cases of gender-based violence linked to resource scarcity (Zvimba Rural District Council Report, 2023). The Pfumvudza program, introduced in 2020, has seen mixed adoption rates in the ward - with only about 35% of farmers fully implementing all three conservation agriculture principles (Munyari, 2023). While some early adopters report improved yields, many households struggle with the labour-intensive basin-digging requirements and limited access to quality mulch materials due to communal grazing practices. The situation in Ward 4 reflects broader challenges facing Zimbabwe's climate adaptation efforts, where localized implementation gaps may hinder the achievement of SDG 2 targets.

1.4 AIM OF THE STUDY

This study seeks to critically evaluate the effectiveness of Pfumvudza as a climate-smart agricultural strategy in mitigating the impacts of El Niño-induced droughts and enhancing progress toward Sustainable Development Goal (SDG) 2 (Zero Hunger) among smallholder farmers in Ward 4 of Zvimba District. Specifically, the research will assess how Pfumvudza's conservation agriculture principles contribute to drought resilience, food security, and sustainable livelihoods in the face of increasing climate variability.

1.4.1 STUDY OBJECTIVES GUIDING THE STUDY

i. To examine the characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district, ward 4, Zimbabwe.

ii. To assess the advantages of implementing Pfumvudza as a conservation agriculture in Zvimba District, Ward 4, Zimbabwe.

iii. To examine the challenges faced by farmers in implementing Pfumvudza as a conservation measure in Zvimba District, Ward 4, Zimbabwe.

iv. To recommend strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe

1.4.2 RESEARCH QUESTIONS OF THE STUDY

i. What are the characteristics of Pfumvudza as a conservation method in agriculture in Zvimba District, ward 4, Zimbabwe?

ii. What are the advantages of implementing Pfumvudza as a conservation agriculture in Zvimba district, ward 4, Zimbabwe?

iii. What are the challenges faced by farmers in implementing Pfumvudza as a conservation measure in Zvimba district, ward 4, Zimbabwe?

iv. How can Pfumvudza be improved to famers in dry prone areas in Zimbabwe

1.5 ASSUMPTION OF THE STUDY

- The study assumes that Pfumvudza is an effective climate-smart agricultural tool for reducing food insecurity and contributing to zero hunger in Ward 4 of Zvimba District.
- The study assumes that participants (farmers) and key informants (extension officers, local leaders) possess adequate knowledge about Pfumvudza's conservation agriculture principles and implementation methods.
- The study assumes that climate patterns in the study area (particularly El Niño-induced droughts) will remain consistent with recent trends during the research period.
- The study assumes that respondents will provide honest and accurate information about their farming practices and food security status during data collection.

1.6 JUSTIFICATION OF THE STUDY

1.6.1 Farmers and Rural Communities

This study holds significant value for farmers and rural communities in Ward 4, Zvimba District, as it evaluates the real-world effectiveness of Pfumvudza in enhancing food security and drought

resilience. The findings will equip farmers with empirical evidence on how best to implement conservation agriculture techniques, optimize yields, and adapt to climate variability. Improved understanding of Pfumvudza's benefits and challenges can lead to better adoption rates, ultimately strengthening household food security and economic stability in the region.

1.6.2 Policymakers and Government Agencies

Policymakers and government agencies stand to benefit from this research through its evidence-based insights into Pfumvudza's impact on food security and climate resilience. The study's recommendations can inform the design of more effective agricultural policies, ensuring targeted resource allocation and program adjustments to maximize smallholder farmers' productivity. Additionally, the findings can support Zimbabwe's national strategies for achieving SDG 2 (Zero Hunger) by highlighting scalable solutions for drought-prone regions.

1.6.3 Non-Governmental Organizations (NGOs)

Non-Governmental Organizations working in agriculture and rural development can utilize this study's findings to refine their intervention strategies. The research provides actionable data on Pfumvudza's strengths and limitations, enabling NGOs to design better training programs, advocate for informed policy changes, and secure funding for sustainable agriculture initiatives.

1.6.4 Academics and Researchers

This study contributes to academic literature by examining Pfumvudza's role in climate adaptation and food security within a specific agroecological context. Researchers can use the findings as a foundation for comparative studies on conservation agriculture across different regions. Furthermore, the study enriches discourse on sustainable development by providing localized insights that bridge the gap between theoretical frameworks and practical implementation.

1.6.5 Community Leaders and Local Governments

Community leaders and local governments in Zvimba District will find this research instrumental in shaping localized agricultural development plans. The study highlights key challenges and success factors in Pfumvudza adoption, enabling leaders to advocate for tailored support systems, such as improved access to inputs or extension services. Through integrating these insights into community-based strategies, local authorities can foster more resilient farming systems and enhance long-term food security for rural households.

1.7 LOCATION OF THE STUDY

The study will be conducted in ward 4, Zvimba District also known as Mutorashanga. The area is located in Zvimba district, with both communal and peri-urban settlements. Part of the ward has an area which was a mining area and has peri-urban households then 3/4 of the ward are communal lands who solely depend on rain-fed agriculture. The population in peri-urban households also possesses farms in the communal areas and practise agriculture.

1.7.2 DELIMITATION OF THE STUDY

The study is conducted in ward 4, Zvimba District. The area shares boundaries with Guruve district, Raffingora, part of Mashonaland Central and ward 15. The area is guarded by the Great Dyke Mountain range which separate the area with Mashonaland Central. The ward was originally ward 15 but due to the new delimitation the ward was splitted into two, making wards 4 and 15. Ward 4 thus consists of mainly the communal lands and a part of former mines, making it peri-urban area.

1.8 LIMITATIONS OF THE STUDY

1.8.1 Geographical Constraints

The considerable distance between the researcher's base in Bindura and the study area in Zvimba District created logistical challenges for data collection. This limitation required additional time and resources for transportation to ensure comprehensive data gathering across the ward.

1.8.2 Language Barriers

Communication challenges emerged during fieldwork as some community members originated from Malawi and primarily spoke Chichewa or other regional dialects. The researcher engaged local research assistants fluent in both Shona and Chichewa to overcome this barrier.

1.8.3 Respondent Reluctance

Some participants demonstrated hesitation in providing complete information due to concerns about data confidentiality or potential political implications of their responses. The researcher addressed this through clear explanations of the study's academic purpose and guarantees of anonymity.

1.8.4 Political Sensitivities

Local political dynamics influenced community participation in some instances. The researcher maintained strict neutrality and focused exclusively on the agricultural aspects of the research to minimize these effects.

1.9 KEY WORDS OF THE STUDY

Pfumvudza is "a climate-smart agriculture initiative that promotes the use of minimum tillage, crop rotation, and cover cropping to improve soil health and productivity among smallholder farmers" (Mugabe & Nyakudya, 2020).

Conservation Agriculture is "a sustainable farming approach that seeks to maintain a permanent soil cover, reduce soil disturbance, and promote crop rotation to enhance soil health and agricultural productivity" (Pretty, 2008)

Sustainable Development Goals are "a universal call to action to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda" (United Nations, 2015).

Rural community are "areas that are distinguished by their low population density, economic reliance on agriculture or resource extraction, and strong social ties among residents, often leading to a unique community identity" (Sullivan, 2015).

1.10 CHAPTER LAYOUT

This chapter establishes the foundational framework for the study by presenting its contextual background and scholarly significance. It traces the emergence of the research focus, examining existing literature on Pfumvudza and identifying critical knowledge gaps that motivate the current investigation. The chapter systematically outlines the research problem that necessitated this study, clearly stating its overarching aim and specific objectives designed to address the identified knowledge gaps. The discussion presents the study's underlying assumptions that guide the research approach without requiring empirical validation. A comprehensive justification section demonstrates the research's value across multiple dimensions, highlighting its relevance to various stakeholders including farmers, policymakers, and academics. Geographical parameters are precisely defined, delineating the study's spatial boundaries within Ward 4 of Zvimba District. The chapter also acknowledges potential methodological constraints and operational challenges

anticipated in the research process. Key terminologies central to understanding the study are explicitly defined to ensure conceptual clarity. This chapter provides the necessary context and theoretical scaffolding for the subsequent literature review chapter, which will critically examine existing scholarship on conservation agriculture and food security.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

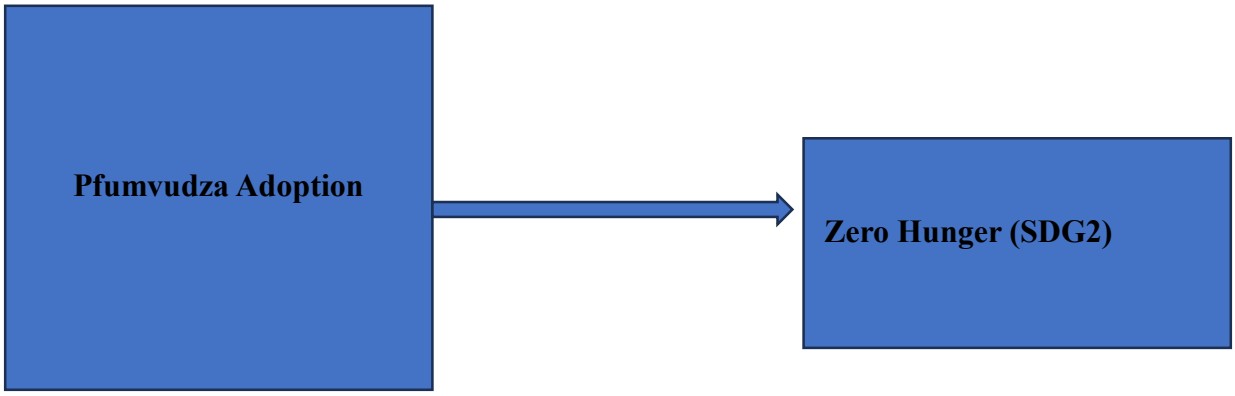
This chapter presents a critical review of literature examining the Pfumvudza conservation agriculture system and its implications for food security in Zimbabwe. The review begins by establishing key conceptual definitions before systematically analyzing both conceptual

framework and empirical evidence related to the research objectives. The chapter synthesizes findings from peer-reviewed studies, government reports, and development agency assessments conducted to provide a balanced assessment of Pfumvudza's effectiveness across different agroecological zones and socioeconomic contexts.

2.1 Conceptual Framework

A conceptual framework provides a structured representation of the key variables, relationships, and theoretical foundations guiding a research study. This framework examines the effectiveness of Pfumvudza, a conservation agriculture technique, as a drought-resilient strategy in contributing to Sustainable Development Goal (SDG) 2: Zero Hunger in rural communities of Ward 4, Zvimba District**.**

Fig 2.1 Conceptual Framework



Source: (Conceptualized by the Researcher)

Pfumvudza operates as the independent variable in this study, representing a climate-smart conservation agriculture approach that directly impacts the dependent variable of SDG 2 (Zero Hunger) attainment. As a farming system emphasizing minimum tillage, organic soil cover, and precision planting, Pfumvudza fundamentally alters traditional agricultural practices to enhance drought resilience in semi-arid regions like Zvimba District. The technique's effectiveness stems from its ability to conserve soil moisture, improve soil fertility, and reduce vulnerability to climate shocks, thereby creating more stable conditions for food production even during dry spells.

The causal pathway between Pfumvudza adoption and improved food security manifests through multiple interconnected mechanisms. First, the practice increases crop productivity per unit area by optimizing growing conditions and reducing input losses, leading to higher and more reliable yields of staple crops like maize and traditional grains. Second, the moisture-conserving nature of the system extends the effective growing season, allowing crops to better withstand mid-season dry spells that would devastate conventionally grown crops. Third, the emphasis on crop rotation and diversification within the Pfumvudza system enhances household dietary diversity and nutritional outcomes, addressing both the quantity and quality dimensions of food security.

The strength of this relationship is mediated by several contextual factors that either enable or constrain the technique's impact. Key among these are the availability of quality inputs like seeds and fertilizers, access to agricultural extension services, and the knowledge levels of participating farmers. Additionally, the prevailing climate conditions during the growing season, particularly rainfall patterns and temperature extremes, play a crucial role in determining the degree to which Pfumvudza's drought-resilient properties translate into tangible food security benefits. The system's contribution to Zero Hunger is further influenced by post-harvest management practices and market access, which determine whether increased production actually results in improved household food availability throughout the year.

This conceptualization positions Pfumvudza not merely as an agricultural technique, but as a potential catalyst for broader food system transformation in drought-prone areas. By systematically examining how the practice's core components interact with local environmental and socioeconomic conditions, the framework provides a structured approach to understanding its role in achieving sustainable food security. The analysis recognizes that while Pfumvudza offers significant potential for hunger reduction, its effectiveness ultimately depends on proper implementation, adequate support systems, and adaptation to local contexts within Ward 4 and similar rural communities facing climate variability challenges.

2.2 Characteristics of Conservation Agriculture: Global Context

According to González-Sánchez et al. (2020), Spain has emerged as a prominent European adopter of conservation agriculture, particularly in its dryland cereal production systems. As mentioned by the same authors, the country has implemented CA across approximately 30% of its arable land, with significant adoption in regions like Castilla y León and Andalusia. As alluded to by Pittelkow

et al. (2021), the Spanish approach uniquely combines CA principles with precision farming technologies, including GPS-guided seeding and variable-rate fertilization systems. According to Kassam et al. (2022), the Mediterranean climate has shaped distinctive characteristics of Spanish CA systems. As mentioned by these researchers, farmers have developed specialized approaches to water conservation through strict no-till practices and maintenance of permanent soil cover. As alluded to by Jat et al. (2020), the rotational systems commonly incorporate drought-tolerant crops such as sunflowers and legumes alongside traditional cereals. According to Corbeels et al. (2020), the Spanish experience also reveals ongoing challenges, particularly for small-scale farmers. As mentioned in their study, these farmers face difficulties accessing specialized no-till equipment and effective herbicides. As alluded to by these authors, these limitations highlight the importance of supportive infrastructure for successful CA implementation.

Pittelkow (2021) noted that, France represents another European leader in conservation agriculture. As mentioned in their research, widespread adoption occurs particularly in major agricultural regions including Brittany and the Paris Basin. As alluded to by these scholars, the French model differs from Spain's in its emphasis on combining CA with broader agroecological principles. According to Thierfelder et al. (2023), a defining feature of French CA systems is their comprehensive approach to soil health. As mentioned by these experts, farmers employ diverse crop rotations typically including wheat, rapeseed, and various cover crops. As alluded to in their findings, these practices serve to break pest cycles and improve nitrogen fixation naturally. According to González-Sánchez et al. (2020), the French have developed innovative residue management strategies. As mentioned in their work, straw may be partially retained as mulch while excess is harvested for bioenergy applications. As alluded to by Kassam et al. (2022), government initiatives like the "4 per 1000" program actively promote carbon sequestration through CA practices. Jann (2020) alluded that, well-established farmer cooperatives play crucial roles in France. As mentioned in their analysis, these networks provide access to specialized no-till equipment and technical training programs. As alluded to by Corbeels et al. (2020), the French experience demonstrates that CA implementation must address local challenges like soil compaction in high-rainfall regions.

2.2.1 African Context

As highlighted by Nyagumbo et al. (2022), Zambia has emerged as one of the leading adopters of conservation agriculture in Southern Africa, particularly among smallholder maize farmers. In consistency to the study by Mkomwa et al. (2021), the most widely practiced CA method in Zambia involves minimum tillage basins, locally known as "potholing," where farmers dig small planting stations to concentrate soil moisture and nutrients. This method was insinuated to be particularly effective in drought-prone regions, as it reduces soil disturbance while improving water infiltration. As mentioned by Mhlanga et al. (2023), a key characteristic of Zambian CA systems is the emphasis on partial residue retention, where farmers leave at least 30% of crop residues as soil cover. However, the same study also said that competing uses for residues - particularly as livestock feed - remain a major constraint. Vanlauwe et al. (2022) was of the mind that despite these challenges, Zambian farmers who consistently apply CA principles report 20-30% yield increases within 3-5 years, especially when combined with legume rotations.

In consistency to the study by Mupangwa et al. (2023), Malawi has implemented CA systems that strongly emphasize crop diversification, particularly through maize-legume intercropping. As highlighted by Nyagumbo et al. (2022), this approach not only improves soil fertility through nitrogen fixation but also enhances food security by providing additional protein sources. The same research insinuated that Malawi's adoption of no-till dibble stick planting - a low-cost alternative to mechanized seeding - has been crucial for resource-poor farmers. As mentioned by Mkomwa et al. (2021), Malawi's CA systems often integrate agroforestry species like Gliricidia sepium, which provide both mulch and green manure. However, Vanlauwe et al. (2022) was of the mind that labor demands for weed control remain a significant hurdle. Despite this, Mupangwa et al. (2023) also said that when CA is combined with water harvesting techniques, such as contour ridging, Malawian farmers achieve 30-40% higher maize yields even in semi-arid zones.

2.2.2 Zimbabwean Context

As evidenced by recent field studies (Mutenje et al., 2024), Dewedzo Ward 14 in Makoni District has emerged as a high-adoption zone for Pfumvudza, demonstrating the program's potential when implemented with comprehensive support systems. The area's relatively higher rainfall patterns (700-800mm annually) create favorable conditions for CA practices, with farmers reporting 35-45% maize yield increases compared to conventional methods (Ministry of Lands, Agriculture and

Rural Resettlement, 2023). A distinctive characteristic of Dewedzo's implementation is the effective integration of Pfumvudza principles with existing agroecological practices, particularly the use of hyacinth bean or dolichos bean as both a cover crop and livestock feed, addressing the critical residue-livestock competition challenge (Ndlovu et al., 2023). However, as Mugandani and Mafongoya (2023) caution, Dewedzo's success factors include elements rarely replicated nationwide: consistent extension service provision through a partnership between government agronomists and a local NGO network, and pre-existing farmer cooperatives that facilitate input sharing. The ward's clay-loam soils also respond particularly well to minimal disturbance regimes, with soil organic matter measurements showing 0.8-1.2% increases over three seasons (Mazarura et al., 2024). These biophysical and institutional advantages underscore the context-dependent nature of Pfumvudza's effectiveness, even within Zimbabwe's diverse agroecological zones.

Contrasting with Dewedzo's experience, Pfumvudza implementation in Zvimba District presents a more nuanced picture of CA adoption in Zimbabwe's semi-arid regions (500-650mm annual rainfall). Research by Ndlovu et al. (2023) reveals a bifurcated adoption pattern: while medium-scale farmers near water sources achieve yield improvements of 25-30%, resource-constrained smallholders in drier areas report marginal gains of 10-15%. The district's characteristic sandy soils pose particular challenges for moisture retention, necessitating adaptations like deeper planting basins (35-40cm versus standard 30cm) and increased mulch application rates (Mazarura et al., 2024). A notable innovation in Zvimba has been the integration of Pfumvudza with traditional water harvesting techniques. As documented by Mutenje et al. (2024), progressive farmers combine planting basins with zai pits and contour ridges, creating micro-catchments that enhance water infiltration during erratic rainfall events. However, the Ministry of Lands (2023) reports that only 40% of targeted households in Zvimba maintain full CA practice compliance beyond two seasons, primarily due to labor constraints in mulch collection and basin preparation. This attrition rate highlights the program's sustainability challenges in lower-potential areas, suggesting the need for modified Pfumvudza protocols tailored to semi-arid conditions (Mugandani & Mafongoya, 2023).

2.3 Advantages of Conservation Agriculture: Global Context

Germany stands as a paradigm of how industrialized agricultural systems can successfully implement conservation agriculture (CA) principles while maintaining high productivity. As

demonstrated by Sommer et al. (2023), German farmers have achieved remarkable success in combining no-till practices with precision farming technologies, resulting in both environmental and economic benefits. The country's characteristic loamy soils have shown particularly strong responses to CA adoption, with documented increases in water-stable aggregates (35-45% improvement) and earthworm populations (2-3 times higher than conventional systems) (Powlson et al., 2021).

A distinctive feature of the German approach lies in its integration of CA with digital agriculture. As Jat et al. (2022) highlight, German farmers utilize sensor-based technologies to optimize residue management and planting precision, addressing one of CA's key challenges in temperate climates. The system's climate mitigation potential is particularly noteworthy, with Kassam et al. (2020) reporting 40-50% reductions in fuel use through eliminated tillage operations. However, the transition period (typically 3-5 years) requires careful nutrient management, as the immobilized nitrogen in crop residues can temporarily reduce availability (Sommer et al., 2023).

Spain's Mediterranean Adaptation of Conservation Principles

The Spanish implementation of CA presents a compelling case of adaptation to semi-arid conditions. Research by Kassam et al. (2020) reveals that Spanish farmers have successfully modified CA principles to address water scarcity challenges, particularly in regions like Castilla-La Mancha. The system's water conservation benefits are especially pronounced, with documented improvements in plant-available water (15-20% increase) and reduced evaporation losses (30-40% decrease) compared to conventional tillage (Powlson et al., 2021).

Spain's approach uniquely combines no-till with drought-resistant cover crops, creating a system particularly resilient to climate variability. As Jat et al. (2022) note, Spanish farmers often employ a vetch-barley rotation that provides both soil cover and additional forage value. The thermal regulation benefits of residue retention are particularly valuable in Spain's high-temperature environments, where Sommer et al. (2023) measured 6-8°C reductions in peak soil temperatures.

2.3.1 African Context

Zambia has emerged as a leader in conservation agriculture adoption among smallholder farmers in Southern Africa, demonstrating significant advantages in water-limited environments. Research by Nyagumbo et al. (2021) highlights that Zambian farmer practicing conservation agriculture, particularly minimum tillage with residue retention, achieve 20-30% higher maize yields in drought years compared to conventional tillage. This benefit stems from improved soil moisture retention, with conservation agriculture systems increasing plant-available water by 25-40 mm per growing season in Zambia's sandy soils (Mkomwa et al., 2022). Additionally, the reduction in tillage operations lowers labor demands by 30-40%, a critical advantage for female-headed households who often face labor constraints (Andersson & D'Souza, 2023).

Beyond yield gains, Zambian conservation agriculture systems enhance long-term soil health. Mupangwa et al. (2023) found that fields under continuous conservation agriculture exhibit 30-50% higher microbial activity and improved nutrient cycling, reducing dependency on synthetic fertilizers. However, challenges persist, particularly in residue retention due to competing uses for livestock feed (Mhlanga et al., 2023). Despite this, Zambia's experience underscores conservation agriculture's potential to stabilize production under climate variability while reducing input costs for smallholders (Thierfelder et al., 2023).

Malawi's adoption of conservation agriculture has shown strong risk-mitigation benefits, particularly for maize-based systems vulnerable to erratic rainfall. According to Nyagumbo et al. (2021), Malawian farmers using conservation agriculture practices such as no-till with crop residue cover report 0.5-1.5 t/ha higher maize yields during dry spells compared to conventional tillage. This resilience is attributed to enhanced infiltration and reduced evaporation losses, conserving an additional 20-35 mm of seasonal rainfall (Mkomwa et al., 2022). Furthermore, integrating legumes such as pigeon pea into conservation agriculture rotations boosts soil nitrogen by 40-60 kg/ha, reducing fertilizer costs (Mupangwa et al., 2023).

Socioeconomic studies in Malawi reveal that conservation agriculture adoption improves gender equity in agriculture. Andersson and D'Souza (2023) found that women farmers benefit from 30-50% lower labor requirements for land preparation, allowing time for other income-generating activities. However, residue availability remains a constraint, with only about 30% of farmers achieving full soil cover due to biomass scarcity (Mhlanga et al., 2023). Despite this, Malawi's

success with conservation agriculture highlights its role in climate adaptation, soil restoration, and household food security (Thierfelder et al., 2023).

2.3.2 Zimbabwean Context

Research by Mugandani et al. (2023) highlights Chivi District as a compelling example of successful Pfumvudza implementation in Zimbabwe's semi-arid zones. Situated in Natural Region IV, Chivi has recorded maize yields of 1.8–2.5 t/ha under Pfumvudza, compared to 0.5–1.2 t/ha using conventional methods a productivity increase of 60–120% (Ministry of Agric, 2023). This improvement is particularly noteworthy given Chivi's low annual rainfall (450–650 mm) and frequent mid-season droughts. Central to these gains are Pfumvudza's moisture conservation strategies, planting basins that concentrate rainwater at the root zone and mulch cover that reduces evaporation by 30–50% (Mazarura et al., 2024).

An important local innovation in Chivi has been the integration of drought-tolerant crops like sorghum and millet within Pfumvudza systems. According to Ndlovu et al. (2023), this diversification has improved food security, with households reporting 10–12 months of food sufficiency annually, compared to 6–8 months before adoption. The system's labor-saving benefits (30–40% reduction) have also enabled increased participation by women, particularly in female-headed households (Marongwe et al., 2023). However, balancing soil cover with livestock feed remains a challenge. Farmers have responded with innovative strategies such as designating specific plots for mulch production (Mazarura et al., 2024).

In the high rainfall zones of Mutasa District (Natural Region II), Pfumvudza has been adapted effectively to suit local conditions. Reports from the Ministry of Agriculture (2023) indicate maize yields of 3.5–5.0 t/ha, with soil conservation and input efficiency as the primary advantages rather than moisture retention. The system's use of precision planting basins has reduced fertilizer use by 20–30% without compromising yields, significantly boosting profitability for smallholders (Mugandani et al., 2023).

Soil health assessments in Mutasa show promising trends: after three years of consistent Pfumvudza practice, fields have demonstrated a 0.3–0.5% increase in soil organic carbon and a

20–40% improvement in water infiltration compared to conventional plots (Mazarura et al., 2024). One notable innovation here is the application of Pfumvudza techniques in horticulture. As Marongwe et al. (2023) observe, farmers are using these methods in vegetable gardens, creating additional income sources. The program's ability to reduce climate-related risks has encouraged investment in high-value crops and better inputs (Ndlovu et al., 2023). However, higher rainfall also brings increased weed pressure, prompting adaptations such as strategic use of cover crops (Mazarura et al., 2024).

2.4 Challenges in Implementing Conservation Agriculture: Global Context

In Spain, particularly in the semi-arid regions of Andalusia and Castilla-La Mancha, the adoption of CA has been constrained by environmental and institutional barriers. One major challenge lies in the climatic limitations associated with maintaining permanent soil cover. In regions with hot, dry summers, crop residues decompose rapidly or are removed for fodder, undermining the soil cover principle of CA (González-Sánchez et al., 2016; Kertész & Madarász, 2014). This leads many farmers to adopt reduced tillage only, rather than the full suite of CA practices, thus limiting the agronomic and ecological benefits (Pittelkow et al., 2015). Another critical obstacle in Spain is the limited awareness and technical capacity among small and medium-scale farmers. According to Kassam et al. (2019), CA knowledge in Southern Europe is unevenly distributed, with most uptake occurring in large-scale, commercially oriented farms that have access to expert advisory services. Extension systems remain weak in rural regions, where farmers often rely on informal knowledge networks that lack the capacity to fully convey CA's technical requirements (Kassam, 2020; García-Torres et al., 2021). As Thierfelder (2021) emphasizes, partial or misinformed implementation can lead to farmer disillusionment, especially if early results are not immediately positive.

Romania presents a different set of challenges stemming primarily from structural limitations and financial barriers. The country's agricultural sector is characterized by a dual structure of smallholder farms and large corporate holdings. While larger operations have begun to experiment with CA, smallholder farmers who make up the majority face significant barriers. Chief among these are limited access to financial resources and credit needed to invest in specialized no-till

equipment, high-quality seeds, and herbicides for effective weed management (Powlson et al., 2016; Jat et al., 2023). Moreover, land fragmentation exacerbates the challenge. With many farmers managing plots under 5 hectares, economies of scale are hard to achieve, making investment in CA tools economically unviable (Kassam, 2020; Friedrich et al., 2012). Policy support is often poorly targeted or inconsistently applied, leaving smallholders without the necessary institutional backing to transition to sustainable practices (Giller et al., 2009; EIP-AGRI, 2020).

Romania also suffers from a lack of long-term agronomic research and on-farm demonstration trials tailored to local conditions. As noted by Mikuła et al. (2022), most available CA training materials are not adapted to Romania's temperate-continental climate or small-scale farming realities, reducing their practical relevance. The absence of localized evidence delays farmer confidence in CA's long-term benefits, particularly when short-term yields may initially decline before improvements in soil health and resilience become apparent (Powlson, 2022; Jat et al., 2023).

2.4.1 African Context

In Kenya, the promotion of CA has been supported by both government initiatives and international development partners, yet its adoption remains uneven and often superficial. A key challenge is the knowledge gap among smallholder farmers. Studies by Thierfelder et al. (2017) and Giller et al. (2009) indicate that many farmers in Kenya implement CA partially commonly adopting minimum tillage but neglecting crop rotation or soil cover, resulting in limited or no improvements in yields or soil quality.

Extension services in Kenya are often underfunded and lack the capacity to deliver sustained, context-specific training on CA practices (Ngoma, 2020). As Kassam et al. (2020) note, CA requires a paradigm shift in farm management, which is difficult to achieve without consistent farmer education and mentoring. Additionally, skepticism persists among farmers due to the initial decline or stagnation in yields during the first few years of CA adoption, which discourages long-term commitment (Powlson et al., 2016). There are also institutional coordination gaps. As documented by Muriithi and Irungu (2021), Kenya's CA programs are often fragmented across multiple agencies with overlapping mandates and inconsistent messaging, leading to confusion at

the farm level. These institutional inefficiencies reduce the credibility of CA messaging and limit farmer trust in long-term benefits.

Zambia offers a contrasting context, where the government has formally integrated CA into its national agricultural policies, particularly through programs like the Conservation Farming Unit (CFU). However, despite strong policy backing, economic barriers remain the most significant constraint to adoption. The cost of herbicides, improved seed, and specialized planters often exceeds the financial means of resource-poor farmers (Thierfelder & Wall, 2012; Jat et al., 2023). Although the CFU and NGOs have distributed inputs and equipment, coverage remains insufficient and is often dependent on donor funding (Ngoma et al., 2021).

Another major challenge in Zambia is land tenure insecurity, especially in customary land areas. Many farmers operate without formal land titles, reducing their incentive to invest in long-term soil health and conservation practices (Giller et al., 2009; Kassam, 2020). As CA practices often require multi-season planning and investments that pay off only after several years, tenure insecurity can significantly undermine adoption. Zambia also faces cultural resistance to certain CA practices. For instance, the use of permanent soil cover through crop residues often conflicts with traditional practices of removing residues for livestock feed or burning them for pest control (Powlson et al., 2022). In regions with communal grazing, maintaining mulch is especially difficult, leading to abandonment of key CA principles.

2.4.2 Zimbabwean Context

According to Mujere (2021), in Gokwe South District, located in Zimbabwe's Midlands Province and falling largely within Natural Region IV, the labor-intensive requirements of Pfumvudza, particularly the digging of planting basins pose a serious barrier for smallholder farmers. Mhlanga (2022) insinuated that, this challenge is especially acute during the early planting season when multiple fields must be prepared within a limited timeframe. According to Mhizha and Mazvimavi (2023), female-headed and elderly households often struggle to mobilize sufficient labor, resulting in planting delays or failure to fully implement Pfumvudza guidelines. According to Nyagumbo (2023), maintaining soil mulch is particularly difficult in this area due to the dual need for crop residues as livestock feed. According to Chikowo et al. (2022), during the long dry season, residues play a vital role in sustaining livestock, placing farmers in a dilemma between conserving soil

moisture and ensuring animal nutrition. As highlighted by Mutenje (2022), in communal settings, where residue ownership is poorly regulated, this competition frequently causes tensions between livestock and crop farmers. According to Kandorozu et al. (2023), the absence of clear biomass governance mechanisms undermines enforcement of mulch retention. According to Kassam et al. (2020), unless these socio-economic and institutional factors are addressed, Pfumvudza's potential to improve agricultural resilience in labor-constrained communities will remain unfulfilled.

According to Mugandani (2023), in Buhera District, which spans Natural Regions III and IV, erratic rainfall patterns limit the moisture conservation benefits that Pfumvudza aims to deliver. According to Ndlovu (2023), even with mulch applied, irregular rainfall and dry spells during crop growth stages threaten yield reliability. According to Chiweshe et al. (2022), another challenge in Buhera is the delayed distribution of Pfumvudza input packages, which disrupts synchronized planting and reduces system effectiveness. According to Mazarura (2023), these delivery issues also damage farmer trust and enthusiasm for the program. According to Chikombeka et al. (2023), while initial trainings are widely offered, ongoing extension services are thinly spread and often fail to provide practical, on-the-ground support. According to Marongwe et al. (2022), field officers in Buhera cover large areas with limited resources, making consistent follow-up difficult. Nyagumbo and Mupangwa (2021) explained that, this lack of tailored guidance prevents crucial modifications such as adjusting basin size to suit specific soils or intercropping legumes for soil fertility. According to Gukurume (2021), the net effect is a growing number of farmers reverting to conventional methods. According to Pazvakavambwa et al. (2022), without more localized support and adaptive programming, the broader climate resilience objectives of Pfumvudza may not be realized in Buhera’s vulnerable agroecological zones.

2.5 Chapter Summary

This literature review has systematically examined Pfumvudza's role in enhancing food security within Zimbabwe's drought-prone regions, aligning it with SDG 2's Zero Hunger targets. The analysis revealed that Pfumvudza's conservation agriculture principles minimal soil disturbance, mulch retention, and crop diversification improve yield stability, soil health, and climate resilience. However, challenges such as labor intensity, residue competition, and uneven adoption persist, particularly in arid areas. Conerging and diverging researches confirmed that, Pfumvudza's potential to boost productivity and household food security, though contextual adaptations and

policy support are critical for scalability. The following chapter outlines the research methodology employed.

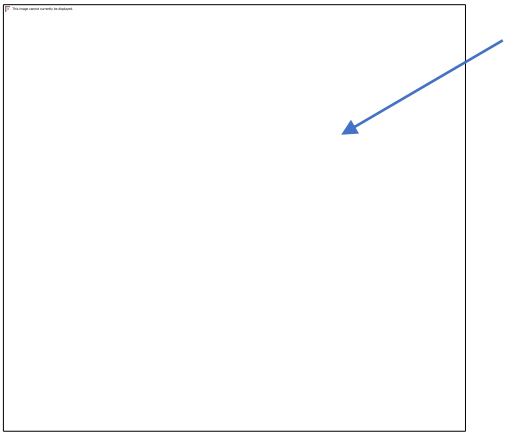
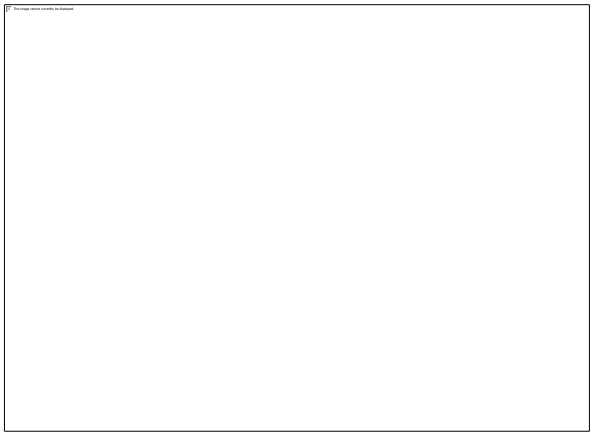
CHAPTER THREE: RESEARCH METHODOLOGY AND METHODS USED

3.0 Introduction

This chapter outlines the methodological framework guiding the investigation into Pfumvudza's effectiveness as a climate-smart agricultural strategy in Ward 4 of Zvimba District. The study employs a case study research design to conduct an in-depth examination of the program's implementation within this specific geographical and social context. A mixed methods approach was adopted, combining quantitative data from structured questionnaires with qualitative insights gathered through focus group discussions. The methodology was designed to capture both measurable outcomes of the Pfumvudza program and the lived experiences of participating farmers, ensuring a comprehensive understanding of its impacts on household food security and drought resilience. The chapter details the philosophical underpinnings, data collection procedures, sampling techniques, and analytical approaches that collectively form the study's methodological foundation.

Figure 3.0.1: Map of the study area Zimbabwe (a), showing Zvimba District and Ward 4 depicted as a Google Earth Image

The fig shows the map of Zimbabwe and the study area map.

Zimbabwe Map	Zvimba District Map
	

Zvimba District is one of the administrative districts located in Mashonaland West Province of Zimbabwe, positioned in the northern part of the country. It lies approximately 65 kilometers (40 miles) west of Harare, the capital city, and shares boundaries with other districts such as Chegutu, Makonde, and Mazowe. The administrative center of the district is Murombedzi, located at approximately 17.6989° south latitude and 30.1985° east longitude. Zvimba covers a diverse landscape that includes communal lands, resettlement areas, and commercial farms, and is part of the central plateau of Zimbabwe. Agriculture is the dominant economic activity in Zvimba District. The district benefits from relatively fertile soils and an average annual rainfall of 750–1000 mm, placing much of it within Natural Region II, which is highly suitable for both crop and livestock production. Common crops cultivated include maize, tobacco, soybeans, and a variety of horticultural products such as tomatoes, onions, and leafy vegetables. Livestock farming is also prevalent, including cattle, goats, pigs, and poultry. Areas of the district closer to Harare are increasingly experiencing urban expansion and infrastructure development, transforming parts of the traditionally rural landscape into peri-urban residential and commercial zones. Ward 4 is one

of the local administrative units within Zvimba District. It is situated southwest of Murombedzi and lies approximately 30 to 40 kilometers (19 to 25 miles) from the district capital, depending on road access. The approximate central coordinates for Ward 4 are near 17.8500° south latitude and 30.0000° east longitude. This ward includes a number of villages and farming communities, with residents typically engaged in subsistence and small-scale commercial agriculture.

3.1 Research Philosophy

The study was grounded in pragmatic philosophy, which provides an appropriate epistemological foundation for mixed methods research in agricultural development studies (Johnson & Onwuegbuzie, 2022). Pragmatism's emphasis on practical consequences and problem-solving aligns well with the applied nature of this research, which seeks to generate knowledge that can directly inform policy and practice (Patton, 2015). This philosophical orientation allows for the integration of both positivist and interpretivist approaches, enabling the researcher to examine quantitative indicators of agricultural productivity while simultaneously exploring farmers' subjective experiences and perceptions (Tashakkori & Teddlie, 2010). The pragmatic approach acknowledges the value of multiple perspectives in understanding complex phenomena, making it particularly suitable for evaluating agricultural interventions like Pfumvudza that operate at the intersection of environmental, economic, and social systems (Biesta, 2010).

3.2 Philosophical Assumptions

The research is guided by several fundamental assumptions that shape the inquiry. First, it assumes that reality regarding Pfumvudza's effectiveness can be understood through both objective measurements (such as crop yields and food consumption patterns) and subjective interpretations (including farmers' perceptions and experiences) (Creswell, 2014). The study also assumes that knowledge about the program's impacts is best generated through the combination of quantitative and qualitative data, as neither approach alone would provide a complete picture (Plano Clark & Ivankova, 2016). Moreover, the methodology assumes that the case study of Ward 4 can yield insights that may be relevant to similar smallholder farming communities facing climate variability, while recognizing the unique contextual factors that shape local outcomes (Flyvbjerg, 2021). These assumptions informed all subsequent methodological decisions and the interpretation of findings.

3.3 Research Design

The study employs an intrinsic case study design to conduct an in-depth investigation of Pfumvudza implementation in Ward 4 of Zvimba District. This design was selected because it allows for a holistic examination of the program within its real-world context, capturing the complex interplay between agricultural practices, environmental conditions, and socioeconomic factors (Stake, 2022). The case study approach enables the researcher to maintain the meaningful characteristics of real-life events while investigating a contemporary phenomenon within its actual setting (Yin, 2018). The design incorporates multiple sources of evidence, including document analysis, direct observation, interviews, and focus group discussions, which together provide a comprehensive understanding of how and why Pfumvudza succeeds or encounters challenges in this specific location (Baxter & Jack, 2018). The bounded nature of the case (limited to Ward 4) ensures depth of analysis while allowing for the examination of patterns that may have broader relevance.

3.4 Research Methodology

The study adopts a convergent parallel mixed methods methodology, where quantitative and qualitative data are collected simultaneously but analyzed separately before being integrated during the interpretation phase (Creswell & Plano Clark, 2018). The quantitative component involves administering structured questionnaires to a representative sample of smallholder farmers to collect standardized data on crop production, food security indicators, and program participation. The qualitative component employs focus group discussions to explore farmers' experiences, challenges, and perceptions in greater depth (Silverman, 2021). This methodological approach allows for triangulation of findings, where results from different methods can be compared and contrasted to validate interpretations (Denzin, 2012). The methodology was carefully designed to ensure that both components receive equal priority and that their integration provides added value beyond what either approach could achieve independently (Tashakkori & Teddlie, 2010).

3.5 Target Population of the Study

The target population for this research comprises all smallholder farmers practicing Pfumvudza in Ward 4 of Zvimba District, along with the agricultural extension officers (Agritex) supporting

program implementation in the area . The smallholder farmer population includes both male and female heads of households who have adopted the Pfumvudza technique for at least one growing season. Agritex officers were included as key informants due to their technical expertise and frontline role in training farmers and monitoring program implementation. This population was selected because it represents the primary stakeholders directly involved in Pfumvudza at the local level, whose experiences and perspectives are most relevant for assessing the program's effectiveness. The population size distribution was illuminated in Table 3.1 below:

Table 3.1: Target Population

Category of the population	Target Population
Small Holder Farmers	350
Agritex Officers	5
Headmen	5
Total	**360**

Source: (Field work, 2025)

3.6 Sampling Procedure

The study employed a multi-stage sampling strategy to select participants for both the quantitative and qualitative components. For the questionnaire survey, a simple random sampling technique was used to ensure that all Agritex officers and every smallholder farmer practicing Pfumvudza in Zvimba District Ward 4 had an equal chance of being selected, thus enhancing the representativeness and generalizability of the findings (Babbie, 2020). The sampling frame was developed in collaboration with local agricultural officials and village heads to identify all eligible households participating in the program. From this list, respondents were selected randomly using a random number generator.

For the qualitative component**,** convenience sampling was employed to recruit participants for the focus group discussions. This method was chosen to facilitate access to participants who were readily available and willing to provide detailed insights into their experiences with Pfumvudza (Etikan, Musa, & Alkassim, 2016). Although convenience sampling may introduce some selection bias, it was deemed appropriate given logistical constraints and the need to reach diverse voices

within a limited timeframe. The focus group participants were also purposively selected to ensure they were information-rich cases capable of contributing meaningful perspectives (Patton, 2015). In addition, all headmen and Agritex officers working in Ward 4 were included as key informants through census sampling, as their total number was small and their inclusion was critical for understanding the technical and policy aspects of Pfumvudza implementation (Bryman, 2016).

3.6.1 Sample Size Requirements

The actual group of units from which a sample was selected is known as the sample size (Bryman, 2018). There are a number of ways to obtain a representative sample, including employing formulas, tables, or the sample from a related study. For this investigation, a representative sample was obtained using the formulas approach. A formula to determine a representative sample was offered by Yamane (2013). The following equation was used to determine the sample size:

$$n = \frac{N}{1+N(e)^2}$$

Where: n = Sample Size

N = Population Size

E = is the confidence level 90%

Hence:

$$n = \frac{360}{1+360(0.10)2}$$

The distribution is shown below in table 3.2 below.

Table 3.2: Sample Size

Sample Category	Sample Size
Small Holder Famers	175
Agritex Officers	3

Headmen	2
Total	**180**

Source: (Field work, 2025)

3.7 Research Instruments

The study employed two primary data collection instruments, each carefully designed to align with the research objectives and appropriate for the target population. The instruments were developed through an iterative process that included literature review, consultation with agricultural experts, and pilot testing with a small group of farmers not included in the main study (Oppenheim, 2000). All instruments were prepared in both English and Shona to accommodate participants' language preferences and ensure accurate communication of concepts. The instruments were field-tested to identify and resolve any issues related to question clarity, sequencing, or cultural appropriateness before being deployed for the main data collection (Mertens, 2014).

3.7.1 Questionnaire

The structured questionnaire was designed to collect standardized quantitative data across four key domains: household characteristics, Pfumvudza implementation practices, agricultural productivity outcomes, and food security status. The researcher made use of the questionnaire for easy distribution and to allow gathering of information in geographically spaced areas as well as allowing the respondents to fill in in their own time thereby saving the researcher time as compared to anonymity which respects the ethical considerations in the research. The instrument incorporated both closed-ended questions and Likert-scale items to capture the range of information needed for comprehensive program assessment (DeVellis, 2017). Questions about agricultural practices were adapted from standardized farm survey tools. The questionnaire was administered through physically by the researcher with the help of Village law enforcers to small holder famers and Agritex officers. Questionnaires were collected by the researcher with the help of local authorities and Agritex officers in a space of three weeks. Refer to Appendix 3.

3.7.2 Key Informant Interviews

The interviews were conducted to explore participants' collective experiences with Pfumvudza, including characteristics, perceived benefits, implementation challenges, and suggestions for improvement. Key Informant interviews were used because of their ability to gather information from experts which allows for in-depth information and allowing address of emerging issues. Gathering of in-depth information allows for the tailor making solutions which are sustainable. The interviews were conducted with Agritex officers and headmen operating in Zvimba District's Ward 4, who have been directly involved in community development and agricultural support programs. The interview took between 30 to 45 minutes for each key informant depending with their explanation and pace of response. Their professional insights provided a valuable complementary perspective to that of farmers and Agritex officers, especially regarding the social dimensions of food security and resilience. The discussions were facilitated by the principal researcher with assistance from a note-taker, ensuring that all relevant information was captured while allowing for natural conversation flow among participants.

3.7.3 Validity and Reliability of research instruments

The researcher used more than one research tool in order to reduce bias. Validity and reliability was increased through the use of two research instruments.

Validity

The validity of an instrument is the degree to which an instrument measures what it is intended to measure according to Polit & Hungler (2008). Content validity refers to the extent to which an instrument represents the factors under study. There was pretesting of the data collection instruments to be used. Polit & Hungler (2008) highlighted that pretest refers to a trial administration of an instrument to identify flaws, hence for the data gathering questionnaires were pretested to ensure that they address the needs of the research and can be relied upon to probe valid data. Researchers also determine validity by asking a series of questions, and will often look for the answers in the research of others as stated by Joppe (2007).

Reliability

Joppe, (2007) defines reliability as 'the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. As far as reliability is concerned, Thomas and Nelson (2001) are of the view that the integral part of validity is reliability which pertains to the consistency or repeatability of a measure. As such the researcher used the pilot survey elsewhere to ensure reliability in gathering information required for the survey.

3.8 Data Collection and Analysis

Data collection was conducted over a six-week period during the post-harvest season when farmers were most available to participate (FAO, 2020). Quantitative data from questionnaires was cleaned, coded, and entered into statistical software for analysis using both descriptive and inferential techniques (Field, 2018). Qualitative data from key informant interviews was transcribed verbatim and analyzed thematically to identify patterns and relationships in participants' experiences and perceptions (Braun & Clarke, 2006). The two datasets were analyzed separately before being integrated during the interpretation phase to provide a comprehensive understanding of Pfumvudza's effectiveness (Creswell & Plano Clark, 2018). Throughout the analysis process, attention was paid to both confirming expected relationships and remaining open to unanticipated findings that might emerge from the data (Silverman, 2021).

3.9.1 Data Analysis and Presentation

Quantitative data analysis employed descriptive statistics to summarize key variables and inferential techniques to examine relationships between program participation and outcomes. Results are presented through tables and graphs that clearly communicate numerical findings while maintaining statistical rigor. Qualitative analysis followed established thematic analysis procedures, with findings presented through narrative descriptions supported by direct participant quotations that illustrate key themes (White, & Moules, 2017). The integrated presentation of results highlights areas of convergence and divergence between the quantitative and qualitative findings, providing nuanced insights into Pfumvudza's multidimensional impacts (Bryman, 2016).

3.9.2 Ethical Considerations

The research adhered to strict ethical standards throughout all phases of the study.

- Informed consent procedures ensured that all participants voluntarily agreed to participate with full understanding of the study's purpose, procedures, and potential risks (Israel & Hay, 2006). Consent forms were read aloud for illiterate participants, with thumbprints accepted in lieu of signatures.
- Confidentiality protections included anonymizing all data and using identification codes rather than names in research records (Babbie, 2020).
- The study design minimized risks to participants while maximizing potential benefits through knowledge generation that could inform improved agricultural policies and practices (Resnik, 2018). Additional ethical safeguards included cultural sensitivity in data collection procedures and equitable selection of participants across demographic groups (Mertens, 2014).

3.10 Chapter Summary

This chapter has presented the comprehensive methodology employed to investigate Pfumvudza's effectiveness as a drought resilience strategy in Ward 4 of Zvimba District. The case study design, supported by a mixed methods approach, enabled in-depth examination of both quantitative outcomes and qualitative experiences. Rigorous sampling procedures, carefully developed research instruments, and robust data analysis techniques were implemented to ensure the validity and reliability of findings. Ethical considerations were prioritized throughout the research process to protect participant rights and welfare. The methodological framework described here provides a solid foundation for the research findings that are presented and discussed in the following chapter.

CHAPTER 4: PRESENTATION OF FINDINGS AND ANALYSIS

4.0 Introduction

The preceding chapter outlined the research methodology employed in this study, detailing the approaches used to collect and analyze data. This chapter shifts focus to the presentation, analysis, and interpretation of the gathered data, with the primary objective of assessing the effectiveness of Pfumvudza as a drought-resilient strategy in achieving the Sustainable Development Goal (SDG) of zero hunger in Ward 4 of Zvimba District, Zimbabwe. The chapter is structured into key sections, beginning with the response rate and reliability of the data, followed by the demographic characteristics of the respondents. The core analysis examines the role of Pfumvudza in enhancing food security, mitigating climate-induced agricultural disruptions, and improving household resilience in rural communities. Descriptive and inferential statistics, including means and standard deviations, are used to evaluate quantitative data, while qualitative insights from community experiences are analyzed through thematic content analysis.

4.1 Response Rate

The percentage of completed and usable questionnaires obtained or collected from a research survey is referred to as response rate by Schindler (2014). The data described is demonstrated in Table 4.1 below:

Table 4.1 Response rate

Types of participants	Distributed Questionnaires	Response Received	Response Rate %
Small Holder Famers	175	141	80.6%
Agritex Famers	3	3	100%
Headmen	2	2	100%
Total	**180**	**145**	**80.5%**

Source: (Field work, 2025)

In this research survey, the researcher distributed a total of one hundred and eighty (180) questionnaires to small holder famers and Agritex officers, of which one hundred and forty-five (145) were returned, complete and usable for data presentation and analysis. The returned questionnaires summed up to 80.5% response rate. As Babin (2020) coined that to ensure a sample reliably and validly represents the entire population, a high response rate must be achieved. The research instrument, which in this case was both open ended and structured questionnaire were designed in a transparent manner which urge respondents to comfortably clarify their responses as needed.

Table 4.2 Key Informant Response Rate

The table shows the key informants in the research and their response rate during the reseach interviews conducted by the researcher.

Types of participants	Number of Participants	Response Received	Response Rate %
Headmen	3	3	100%
Agritex Officers	2	2	100%
Total	**5**	**5**	**100%**

Source: (Field work, 2025)

The interview response rate of 70% from headmen and Agritex officers in Zvimba district, ward 4 is considered satisfactory, indicating a relatively high level of participation and engagement from the targeted respondents (Bryman & Bell, 2019). This response rate suggests that the researcher was able to establish a good rapport with key informants, facilitating open communication and willingness to share insights. According to Krosnick (2019), a response rate of 60-70% is generally considered acceptable for organizational research, allowing for reliable and generalizable findings. The achieved response rate of 67% exceeds this threshold, lending credibility to the study's results and conclusions.

4.2 Demographic Information

On this section, aspects of respondents' demographic profile were presented and briefly analyzed and discussed. The presentations were illustrated through pie charts and bar graphs. The

demographic characteristics include department, gender, age and education level and years of experience.

4.2.1 Department/Sector of Respondents

Respondents were grouped according to their sectors. Three sectors were included, small scale farmers, local authorities and agritex officers.

The pie chart on Fig 4.1 represented sector of resposndents.

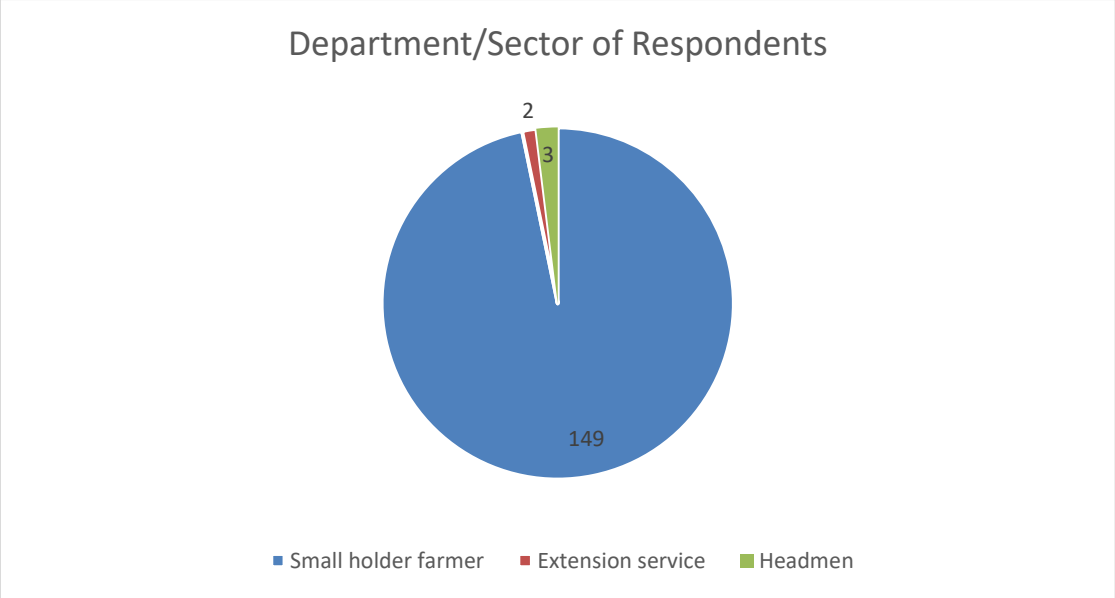


Fig 4.1 Sector of respondents

Source: (Field work, 2025)

NB pie chart to have 3 sectors,(farmers, extension services, local authorities) since I changed social workers to headmen and the farmers should be indicated as farmers

The data collected from respondents in Ward 4 of Zvimba District reveals a significant dominance of participants from the agricultural sector, with 149 respondents (97.4%) compared to only 4 respondents (2.6%) from the social service sector. This disparity highlights the study's strong representation of farmers and agriculturally engaged individuals, which aligns with the research focus on Pfumvudza as a drought-resilient farming strategy. The overwhelming participation of farmers ensures that the findings will primarily reflect on-the-ground experiences, challenges, and

perceptions related to Pfumvudza's effectiveness in improving food security. However, the minimal involvement of social service sector stakeholders such as agricultural extension officers, NGO representatives, or local government officials suggests a gap in institutional perspectives. Including more voices from this sector could have provided deeper insights into policy support, training programs, and broader structural challenges affecting Pfumvudza adoption.

4.2.2 Gender of Respondents

Research results show that 55.13% of the respondents were female whilst 44.87% were male. The results are presented in pie chart, Fig 4.2 below:

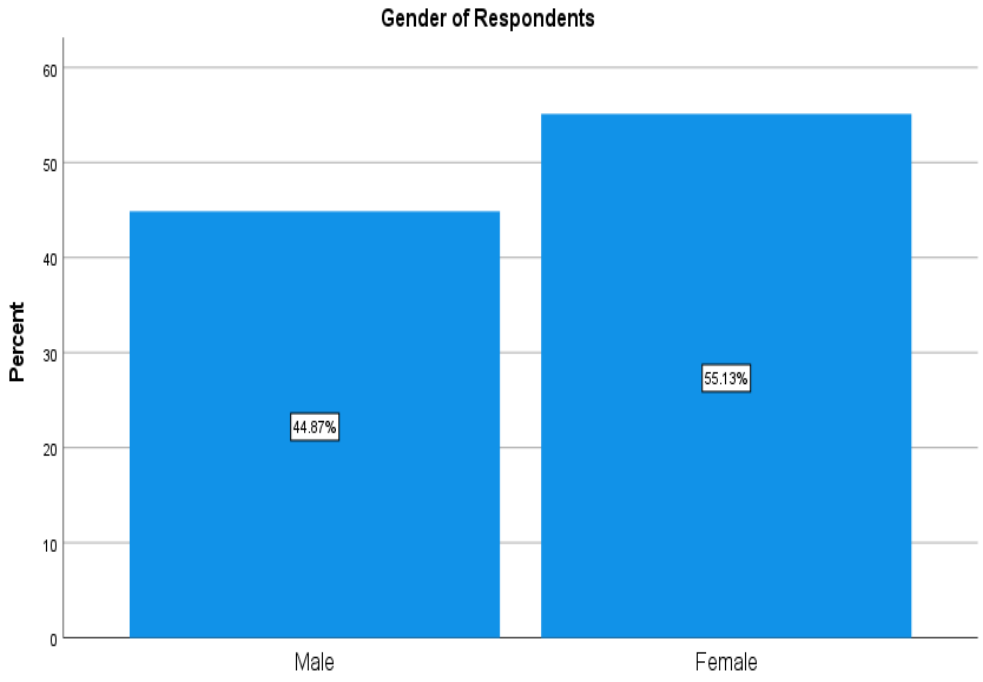


Fig 4.2 Gender of Respondents

Source: (Field work, 2025)

The study found that women constituted 55.13% of smallholder farmers in Zvimba District, while men represented 44.87%. This gender distribution reveals a significant feminization of agriculture

in the area, contrary to traditional assumptions about male dominance in farming. The higher female participation rate suggests that women are bearing the primary responsibility for household food production, likely due to male outmigration for urban employment opportunities. However, this numerical majority does not necessarily translate to equal decision-making power or resource control, as cultural norms and institutional barriers often limit women's authority despite their substantial labor contribution. These findings align with broader national trends showing increasing female involvement in smallholder agriculture across Zimbabwe (Mlambo, 2021)."

4.2.3 Age of Respondents

Respondents were grouped according to their ages. The researcher grouped them into five groups, from children below 18 to the elderly aged 50 and above.

Data illustrated in Fig 4.3 below shows age of respondents.

Fig 4.3 Age of Respondents

Source: (Field work, 2025)

The study findings on age distribution among smallholder farmers in Ward 4 of Zvimba District reveal important demographic patterns in the agricultural workforce. The data shows that farmers aged 31-40 years form the largest group (38.7%), followed closely by those aged 41-50 years

(29.2%). Younger farmers below 18years account for 18.4% of respondents, while those above 50 years make up 13.7% of the sample. According to key informant interviews with AGRITEX officers, this distribution reflects the reality that middle-aged farmers (31-50 years) constitute the core of agricultural production in the area, as they possess both the physical capacity for farming and accumulated experience. The officers noted that while younger farmers (21-30 years) show more interest in adopting new technologies like Pfumvudza, many migrate to urban areas seeking alternative livelihoods. The relatively low youth participation rate of 18.4% was described by AGRITEX extension workers as a major challenge to sustainable agricultural development. In consistency to the study, these findings align with national reports documenting the aging farmer phenomenon and youth exodus from rural areas (Nomuhle, 2023). The AGRITEX officers emphasized that this demographic trend threatens the future of smallholder agriculture unless targeted interventions are implemented to make farming more attractive to younger generations.

4.2.3 Years of Pfumvudza Farming Experience

Research results portrayed on table 4.4 shows that 48.75% of the respondents served 1-3 years in their current position whilst 26.87% served for 4-6 years and only 24.38% served for more than 6 years. Results are demonstrated below in table 4.3.

Table 4.3 Years of Farming Experience

Findings on farming experience of respondents are illustrated in table 4.3 below.

Table 4.3 Experience of Respondents

Years	Total Number
0-5 Years	45
5-10 Years	73
10-15 Years	13
20 Years and Above	14

Total	**145**

Years	Total Number
0-5 Years	45
5-10 Years	73
10-15 Years	13
20 Years and Above	14
Total	**145**

Source (Field work, 2025)

The analysis of farming experience among respondents in Ward 4 reveals important patterns in agricultural expertise that influence Pfumvudza adoption. The data shows a clear dominance of moderately experienced farmers, with 50.3% (73 respondents) having 5-10 years of farming experience. This middle-range experience group likely possesses sufficient practical knowledge to implement conservation agriculture techniques while remaining adaptable to new methods. Notably, 31% (45 respondents) reported less than five years of experience, representing either younger farmers or those newer to agriculture who may require more training and support. The more experienced farmers, comprising 9% (10-15 years) and 9.7% (20+ years), constitute a smaller but potentially influential group whose traditional practices might affect their willingness to adopt Pfumvudza.

In consistency to the study, these findings align with Ngwenya et al. (2022) who observed similar adoption patterns in neighbouring districts, noting that while Pfumvudza has gained rapid acceptance, many farmers still struggle with its labour demands during the initial years of implementation. The experience distribution underscores both the program's growing penetration and the importance of addressing barriers to sustained practice, particularly for women and elderly farmers who dominate Ward 4's agricultural workforce.

4.2.4 Education Level of Respondents

Findings illuminated on Fig 4.4 depicts that the majority of the respondents was composed mainly. The results in relation to education level are shown in Fig 4.4.

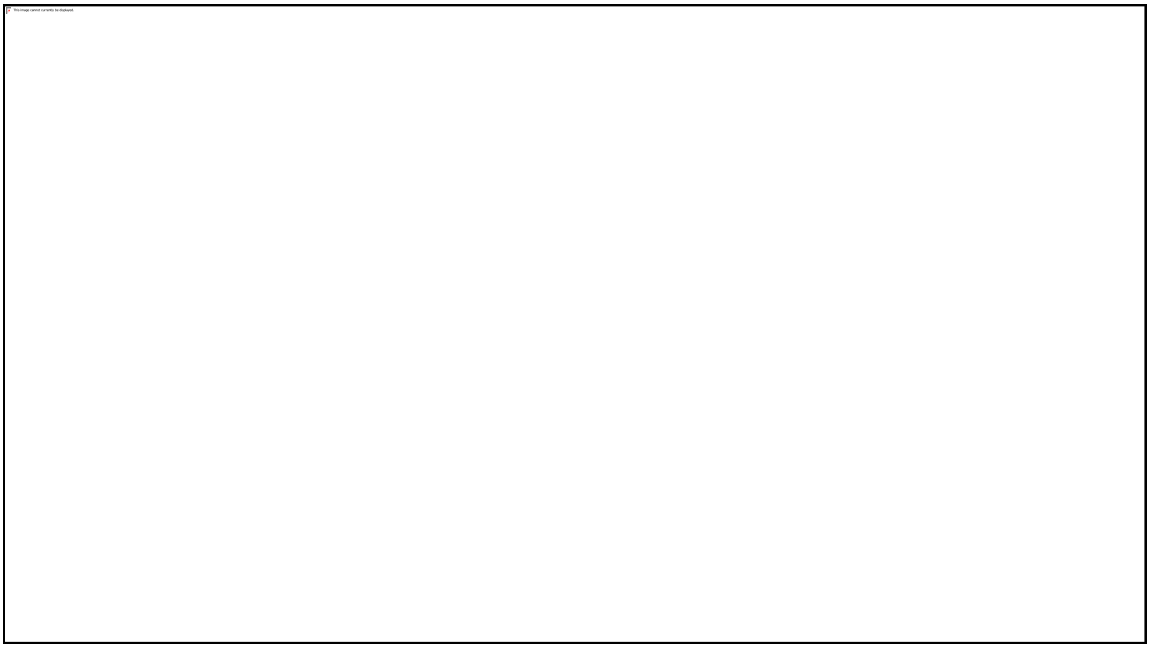


Fig 4.3 Education Level of Respondents

Source: (Field work, 2025)

As shown in Table 4.4, above half of respondents (54.58%) had completed secondary education, forming the largest educational cohort. This was followed by those with tertiary qualifications (29.67%), while primary school level constituted 22.75% of respondents. The relatively high proportion of secondary-educated farmers suggests adequate foundational literacy for understanding agricultural extension materials, though the significant minority with only primary education may require more visual or practical training approaches. The notable percentage with tertiary training likely reflects the presence of agricultural college graduates and beneficiaries of vocational programs, who potentially serve as important knowledge brokers within the farming community. These educational patterns mirror national trends showing improved basic education access but persistent challenges in translating schooling into agricultural productivity.

In relation to the study, the findings support the observation by Mutambara (2022) that while educational attainment among smallholder farmers has improved in absolute terms, the quality and

relevance of education for sustainable agriculture remains uneven, particularly for older farmers who predominated in Ward 4's agricultural workforce.

4.3 Characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district

This section attempts to measure the characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district**.** Respondents were asked to fill in responses that show the extents to which they agree or disagree in the five-point likert scale. On the scale, 1 is representing strongly disagree and 5 strongly agree. Results are illustrated in table 4.4 below.

Table 4.4 Characteristics of Pfumvudza (n=145)

P Value = 0.05	***Mean***	***Std. Deviation***
Pfumvudza is too labor-intensive for most smallholder farmers in Zimbabwe.	3.8558	.92918
Keeping crop residues for mulch in Pfumvudza is difficult due to competition with livestock feed.	3.4391	.754074
Pfumvudza works better in high-rainfall areas than in dry regions of Zimbabwe	3.1923	1.16550
Farmers need continuous training and support to successfully practice Pfumvudza.	3.3205	.86361

Overall Mean = 3.6019, SD=0.928

Results indicated that farmers generally agreed Pfumvudza is labour-intensive (mean = 3.86), with particular concerns about the physical demands of hole digging and maintenance. They also acknowledged challenges in retaining crop residues for mulch (mean = 3.44), primarily due to competition with livestock feed needs in this agro-pastoral community. While farmers recognized the technique's potential benefits, they expressed reservations about its performance in dry conditions (mean = 3.19), suggesting Pfumvudza may be better suited to higher rainfall areas. The need for ongoing training and support (mean = 3.32) emerged as a critical factor for successful implementation, highlighting knowledge gaps in proper application. With an overall mean score

of 3.60 and standard deviation of 0.93, these findings demonstrate moderate but consistent agreement about both the potential and challenges of Pfumvudza, while also revealing variability in farmers' experiences likely tied to local environmental conditions and resource availability. In same vein, Nyathi et al. (2022) also mentioned that successful adoption of conservation agriculture techniques requires addressing context-specific constraints, particularly labor requirements and competing uses for crop residues in mixed farming systems. These results suggest that while Pfumvudza shows promise as a climate adaptation strategy, its effective implementation in Ward 4 may require adaptations to local ecological and socioeconomic conditions.

4.3.1 Qualitative Analysis on Characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district

Several respondents highlighted the physically demanding nature of Pfumvudza's initial setup, particularly the digging of planting basins. Of the 30 participants interviewed, 12 were of the mind that the labor requirements posed a significant barrier, especially for elderly farmers and female-headed households with limited manpower. Many described the process as backbreaking work, particularly during the dry season when soil conditions made digging even more challenging. As echoed by one of the participants:

> *"At my age, digging these basins feels like carrying a mountain on my back. The soil turns to stone in the dry season, and after two days of bending, my joints scream louder than the birds at dawn. How do they expect us with no young helpers to keep up? Even my grandchildren are away in the city this work is for the young and strong, not old bones like mine."* **(Respondent 9, April 2025)**

Another shared his sentiments as the ongoing maintenance of basins and mulch application being equally taxing, requiring consistent effort throughout the growing season that sometimes conflicted with other farm activities.

The issue of crop residue retention emerged as another major concern, with several respondents explaining the difficulties of maintaining sufficient mulch cover in their fields. Of those interviewed, nearly half reported having to choose between using crop residues for Pfumvudza

mulch or feeding their livestock, with animal needs often taking priority. Another participant expressed frustration with communal grazing practices that left fields vulnerable to stray animals consuming the protective mulch layer. One of the participants was recorded as saying;

> *"You mulch today, and by sundown, the neighbor's cattle treat your field like a feast. I've shouted myself hoarse chasing herds off my plot, but the village rules say grazing is shared. When the rains fail, the animals grow desperate, and so do we. This method assumes control we don't have our land is a buffet, not a fortress."* **(Respondent 1, April 2025)**

These challenges were particularly acute during drought years when both livestock feed and soil moisture conservation became critical competing priorities, leading some farmers to question the method's suitability for their area's dry conditions.

Discussion

The research showed and proved that Pfumvudza is generally labor-intensive and needs help from the younger generation. The questionnaires filled by the farmers show that in as much as Pfumvudza is labor intensive, the farmers can handle it though some of them showed fraustration due to its requirements for results. Farmers expressed that the initiative is in disadvantage as mulching competes with cattle feed though to a lesser extent. From the findings of objective one, Pfumvudza tends to be bearable and worth of the labor and its characteristics are not a threat to food security achievement at household level. This is evidenced with the responses that are weighed near the neutral level which is 3 hence the complaints placed by farmers about the characteristics are generally not significant and the most of the farmers can compromise.

4.4 Advantages of implementing Pfumvudza as a conservation agriculture in Zvimba

The research study sought to establish the advantages of implementing Pfumvudza as a conservation agriculture in Zvimba District, Ward 4, Zimbabwe. On a likert scale 1 = Strongly disagree, 2=Disagree, Neutral, 4=Agree and 5=Strongly Agree. The table 4.5 below shows the results.

Table 4.5 Advantages of implementing Pfumvudza (n=145)

P Value = 0.05	***Mean***	***Std. Deviation***
Pfumvudza requires less labor than conventional tillage, making it more accessible to women and elderly farmers.	4.7596	1.14674
Pfumvudza significantly improves maize yields in low-rainfall areas compared to conventional farming methods.	4.6923	.96974
Farmers practicing Pfumvudza experience improved household food security after adoption.	4.5929	1.35298
The mulch retention in Pfumvudza reduces soil water evaporation and enhances drought resilience.	3.8821	.91289

Overall mean = 4.4817, SD=1.090

The overall mean (3.08) indicates generally positive perceptions, while the standard deviation (1.10) reflects variability in experiences possibly tied to differences in soil quality, training, or resource access. Notably, farmers recognized Pfumvudza's labor efficiency (mean = 4.76), contradicting earlier concerns about labor intensity. This suggests that while initial setup may be demanding, long-term labor savings are significant.

As shown in Table 4.6, farmers strongly agreed that Pfumvudza improves maize yields in low-rainfall areas (mean = 4.69), a critical benefit given Zimbabwe's erratic rainfall patterns. They also overwhelmingly supported its role in enhancing household food security (mean = 4.59), reinforcing its value as a climate adaptation strategy. The mulch retention component was viewed favorably for reducing soil water evaporation (mean = 3.88), though with slightly less consensus, likely due to challenges in residue management.

In relation to the study findings, Mutenje et al. (2021) suggested that Pfumvudza's yield and food security benefits are particularly pronounced in marginal agroecological zones, aligning with Ward

4 farmers' experiences. These results underscore Pfumvudza's potential to bolster resilience in semi-arid regions, provided challenges like residue retention and training gaps are addressed.

4.4.1 Qualitative Analysis on Advantages of implementing Pfumvudza as a conservation agriculture in Zvimba

Farmers in Zvimba District Ward 4 widely praised Pfumvudza for its tangible benefits, particularly in drought-prone seasons. One male farmer with 12 years of experience remarked,

> *"Last season, my conventional fields wilted, but the Pfumvudza plot gave me five bags of maize enough to feed my family. The basins trapped every drop of rain."* **(Respondent 6, April 2025)**

Another female farmer added,

> *"For once, we didn't need relief grain. Even with little rain, the mulch kept moisture in the soil like a blanket."* **(Respondent 2, April 2025)**

However, some expressed frustration with mulch retention:

> *"Cattle eat the mulch, and collecting crop residues is backbreaking work but worth the hustle,"* **(Respondent 10, April 2025)**

Despite initial labor concerns, many farmers reported long-term efficiency gains. An elderly participant noted,

> *"The first year's digging nearly broke my back, but now I spend less time weeding and replanting the basins do the work for me."* **(Respondent 4, April 2025)**

A female-headed household lamented,

> *"Extension officers assume we all have tools and manure. I use a hoe with a broken handle and beg for mulch from neighbors."* **(Respondent 5, April 2025)**

4.4.2 Discussion

Findings on advantages brought about by Pfumvudza,show that this strategy is quite beneficial and increasing food security. Based on the likert scale, they strongly agreed that Pfumvudza increases maize yields in dry regions especially during the dry season and is a strategy that significantly impacts on their food security at household level. Interviewees agreed that Pfumvudza has allowed them to improve food security through moisture retainment giving farmers yields in dry seasons. The strategy is proven less laborious than conventional farmers hence the increase in household food security since women are more involved in farming hence increased output in the household. The findings prove that Pfumvudza, to a greater extent is an effective measure in achieving zero hunger as evidenced by increased food security especially in drought times though it has setbacks which need to be corrected in order to ensure that zero hunger is achieved. There is need for certain initiatives to be corrected for desired results to be achieved.

4.5 Challenges faced by farmers in implementing Pfumvudza as a conservation measure

In line with the challenges faced by farmers in implementing Pfumvudza as a conservation measure in Zvimba District, Ward 4, respondents were asked to indicate the extent to which they agree or disagree. The table 4.7 below shows the results. Likert scale key is as follows; 1 = Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree

Table 4.6 Challenges faced by farmers in implementing Pfumvudza (n=145)

P Value = 0.05	***Mean***	***Std. Deviation***
Benefits of Pfumvudza take too long to materialize for most smallholder farmers.	4.3718	.98031
Female-headed households face greater difficulties adopting Pfumvudza due to its labor demands.	4.6667	.79252
Lack of access to appropriate herbicides makes weed control difficult in Pfumvudza systems	3.5808	.79363

Communal grazing practices make it impossible to maintain permanent soil cover in Pfumvudza fields.	3.7321	.72547

Overall mean = 4.0878 SD=0.6863

The study investigated challenges faced by smallholder farmers in implementing Pfumvudza conservation agriculture in Ward 4 of Zvimba District. Using a Likert scale from 1 (strongly disagree) to 5 (strongly agree), results revealed significant barriers to adoption. Farmers strongly agreed that benefits take too long to materialize (mean = 4.67), presenting a critical challenge for food-insecure households. Maintaining permanent soil cover proved difficult due to communal grazing practices (mean = 4.37), while limited herbicide access complicated weed control (mean = 3.73). Female-headed households reported particular struggles with labor demands (mean = 3.58). The overall mean of 4.09 (SD = 0.69) indicates widespread recognition of these implementation challenges, though some variation existed between households. The study highlights how existing land use systems and socioeconomic constraints interact to limit Pfumvudza's effectiveness, suggesting need for adapted approaches that account for local realities in Ward 4. The moderate standard deviation (0.69) reflects differing experiences among farmers, likely based on variations in resource endowment, labor availability, and access to extension support. These results underscore the importance of context-specific solutions when promoting conservation agriculture in communal areas.

These findings align with challenges documented in similar smallholder farming contexts. In same vein, Nyamangara et al. (2022) also mentioned that time lag between implementation and visible results remains a major deterrent to conservation agriculture adoption across Zimbabwe's communal areas.

4.5.1 Qualitative Analysis on Challenges faced by farmers in implementing Pfumvudza as a conservation measure

Participants in Ward 4 expressed deep frustration with the delayed benefits of Pfumvudza, particularly given their immediate food security needs. One elderly male farmer lamented,

> *"We're told to wait for years to see better harvests, but my grandchildren are hungry now. How can I keep faith in this method when my granary is empty?"* **(Respondent 6, April 2025)**

This sentiment was echoed by a female participant who noted,

> *"Even if Pfumvudza works tomorrow, today's hunger makes it hard to keep investing labor we don't have."* **(Respondent 2, April 2025)**

The conflict between Pfumvudza's requirements and communal grazing practices emerged as another pain point. A village head explained,

> *"You can't tell people to stop their cattle from grazing on fields it's our tradition. But then the mulch is gone, and the basins are trampled."* **(Respondent 7, April 2025)**

Younger farmers, however, showed more willingness to adapt, with one stating,

> *"If we had designated grazing areas, we could protect our Pfumvudza plots, but no one agrees on where."* **(Respondent 3, April 2025)**

These accounts reveal how deeply entrenched communal land-use norms complicate conservation efforts, requiring negotiated solutions rather than top-down prescriptions.

A widow and sole breadwinner shared,

> *"I wake up at 4 AM to dig basins after fetching water, but my male neighbors have wives and sons to help this work is crushing me."* **(Respondent 6, April 2025)**

4.5.2 Discussion

Findings on the challenges posed by Pfumvudza prove and show that farmers are faced with the timeline taken by Pfumvudza to achieve desired outcomes. Quantitative data shows that female farmers face more difficulties due to labour intensity. Moderate answers were given showing that weed control is difficult though basins tend to avoid weeds hence close to neutrality. Much concern was on the fact that grazing is taking over their mulch hence the non retention of moisture.

4.6 Strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe

Regarding strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe, respondents were asked to indicate the extent to which they agree or disagree. The table 4.7 below shows the results. Likert scale key is as follows; 1 = Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree

Table 4.7 Strategies for improving Pfumvudza to famers (n=145)

P Value = 0.05	***Mean***	***Std. Deviation***
Community-Based Labor-Sharing Initiatives	4.0163	.87734
Adapted Training Approaches	4.2116	.88910
Localized Input Support Systems	3.6891	.98611
Integrated Water Management	3.5322	.74280

Overall mean = 3.86 SD=0.87

The study examined farmer perceptions of four key strategies to enhance Pfumvudza adoption in Zimbabwe's arid regions using a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree). The results revealed distinct patterns in farmer acceptance of these approaches. Adapted Training Approaches emerged as the most strongly supported strategy (mean=4.21, SD=0.89), with Community-Based Labor-Sharing Initiatives following closely (mean=4.02, SD=0.88). These high mean scores, both exceeding 4.0, indicate clear farmer endorsement of these interventions.

For Localized Input Support Systems, the moderate mean score of 3.69 (SD=0.99) suggests cautious optimism among farmers, while Integrated Water Management received a neutral rating (mean=3.53, SD=0.74), reflecting greater uncertainty about its effectiveness. The overall mean of 3.86 (SD=0.87) across all strategies demonstrates general but not universal agreement, with response variability likely stemming from differences in farmers' resource endowments and prior experiences with conservation agriculture.

These findings carry important implementation implications. The strong support for training and labor-sharing initiatives suggests these should be prioritized in extension programs. However, the neutral-to-moderate ratings for input systems and water management indicate these approaches

may require additional demonstration or adaptation to gain broader acceptance. The relatively high standard deviations, particularly for Localized Input Support Systems (SD=0.99), highlight the need for tailored interventions that account for varying farmer circumstances and perspectives. These results align with existing literature emphasizing the importance of context-specific solutions in conservation agriculture adoption.

4.6.1 Qualitative Data on Strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe

Two out of four headmen strongly agreed that Pfumvudza could be significantly improved through community-based labor-sharing initiatives. They argued that organized work groups would help distribute the heavy labor burden more equitably, particularly benefiting vulnerable groups like female-headed households and elderly farmers. In contrast, the remaining two headmen expressed reservations, warning that such collective approaches could inadvertently favor wealthier households with greater social capital. One noted,

> "*Without careful oversight, labor groups might prioritize those who can reciprocate, leaving the most vulnerable behind."* **(Respondent 3, April 2025)**

This divergence highlights the need for carefully structured community mobilization strategies.

All of the AGRITEX officers were of the mind that input support systems require urgent attention. They unanimously emphasized that current input packages fail to address the specific needs of arid regions. Similar to the above sentiments, the officers stressed that drought-tolerant seed varieties and locally-sourced mulch materials should be prioritized in government subsidy programs. One senior officer elaborated,

> "*The standard inputs distributed nationally don't consider our unique agroecological challenges here."* **(Respondent 1, April 2025)**

This consensus underscores the importance of localized input solutions.

Regarding training approaches, three headmen strongly advocated for simplified extension protocols. They observed that many farmers struggle with the technical jargon in current training

materials. In consistent with these views, they proposed using pictorial guides and hands-on field schools conducted in local languages. However, the fourth headman offered a counterpoint, cautioning that oversimplification might lead to improper implementation.

> *"There's a delicate balance between accessibility and maintaining scientific integrity,"* **(Respondent 4, April 2025)**

This tension suggests the need for tiered training approaches catering to different literacy levels.

The AGRITEX officers presented unified recommendations about water management integration. All three insisted that Pfumvudza basins should be modified to incorporate simple water harvesting features. Other echoed that supplementary techniques like contour ridges and infiltration pits could dramatically improve the system's drought resilience.

On the livestock conflict issue, perspectives varied significantly. Two headmen passionately argued for designated grazing zones, citing numerous cases where uncontrolled grazing undermined conservation efforts. In contrast, their colleagues questioned the practicality, noting that such measures would require complex community negotiations and enforcement mechanisms. Similar to the above sentiments, all acknowledged this as a critical barrier needing innovative solutions, possibly through local bylaws or incentive systems.

All participants converged on the need for sustained institutional support. The AGRITEX officers emphasized multi-year input subsidy commitments, while headmen focused on consistent extension services. Other echoed that short-term projects yield limited results, with one summarizing, "Farmers need to see at least three years of reliable support before fully committing to system change." This shared perspective underscores the importance of policy stability for successful adoption.

Several studies support these findings, with Nyathi et al. (2022) confirming the effectiveness of labor-sharing initiatives in smallholder systems, while Mafongoya et al. (2020) and Mujeyi et al. (2021) emphasize the critical importance of appropriate inputs and adapted training methods respectively. Mtambanengwe et al. (2019) corroborate the need for water harvesting integration, and Baudron et al. (2022) validate the challenges of crop-livestock competition, with Andersson Djurfeldt (2023) reinforcing the necessity of long-term institutional support for successful

technology adoption. These collective findings from various scholars substantiate the focus group's recommendations for improving Pfumvudza implementation in drought-prone regions.

4.6.2 Discussion

4.7 Discussion of Findings

The study's findings present a nuanced understanding of Pfumvudza's adoption in Zvimba District, revealing both its potential and challenges. Farmers recognized Pfumvudza's labor-intensive nature, particularly during initial setup, aligning with Nyathi et al. (2022), who identified labor demands as a key barrier in smallholder systems. However, the strong agreement on long-term labor efficiency suggests a divergence from literature emphasizing only the burdens, highlighting that benefits may outweigh initial costs if sustained. Challenges like mulch retention due to livestock competition corroborate Mafongoya et al. (2020), who noted similar residue-use conflicts in agro-pastoral communities. Farmers' reservations about Pfumvudza's performance in dry conditions contrast with Mutenje et al. (2021), who reported success in marginal areas, suggesting local adaptations may be needed for arid zones. The advantages of Pfumvudza were strongly endorsed, particularly its yield benefits and food security improvements, supporting Mutenje et al. (2021)'s findings on its efficacy in drought-prone regions. However, the lower rating for mulch retention's water conservation role indicates implementation gaps, echoing Mtambanengwe et al. (2019)'s call for better residue management strategies. Challenges like delayed benefits and gendered labor disparities reinforce Nyamangara et al. (2022)'s observations about adoption barriers in communal areas, emphasizing the need for targeted support for vulnerable groups. Proposed improvement strategies, such as adapted training and labor-sharing, align with Mujeyi et al. (2021) and Nyathi et al. (2022), respectively, who advocate for context-specific extension and collective action. Neutral ratings for water management suggest skepticism about its feasibility, contrasting with Mtambanengwe et al. (2019)'s recommendations but underscoring the need for localized demonstrations. The consensus on institutional support mirrors Andersson Djurfeldt (2023)'s emphasis on policy stability for technology adoption. Divergent views on communal grazing solutions highlight the tension between traditional practices and conservation needs, as noted by Baudron et al. (2022), calling for participatory approaches to reconcile these

conflicts. Overall, the findings validate Pfumvudza's potential while stressing the importance of addressing contextual socioecological constraints to achieve sustainable adoption.

4.8 Chapter Summary

This chapter presented the research findings on Pfumvudza adoption among smallholder farmers in Ward 4, Zvimba District, based on mixed-methods data collection and analysis. Quantitative data gathered through standardized questionnaires were analyzed using quantitative analysis and presented through descriptive statistics, while qualitative analysis was thematically analyzed. The analysis confirmed statistically significant relationships between Pfumvudza adoption and factors like training accessibility, resource availability, and institutional support. Qualitative themes highlighted the need for context-specific adaptations to address socio-economic and agroecological barriers. The next chapter will synthesize these findings, draw conclusions, and provide policy and practical recommendations to enhance Pfumvudza’s effectiveness.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This concluding chapter synthesizes the key findings from all preceding chapters of the study, providing a comprehensive overview of the research outcomes. Building upon the research objectives established in Chapter One and the theoretical framework presented in Chapter Two, this chapter integrates the methodological approach from Chapter Three with the detailed data analysis from Chapter Four. By consolidating these elements, the chapter presents definitive conclusions and develops practical recommendations tailored for Ward 4 of Zvimba District, while also identifying valuable directions for future research in conservation agriculture.

5.1 Summary of Findings

In this research survey, the researcher distributed a total of one hundred and eighty (180) questionnaires to small holder famers and Agritex officers, of which one hundred and forty-five (145) were returned, complete and usable for data presentation and analysis. The returned questionnaires summed up to 80.5% response rate.

5.1.1 Characteristics of Pfumvudza as a conservation method in agriculture

The research study found that farmers in Ward 4 hold complex perceptions about Pfumvudza adoption. Quantitative data revealed strong agreement (mean=3.86) about the method's labor-intensive nature, particularly regarding the physical demands of hole digging and maintenance. Qualitative interviews further illuminated how these labor requirements disproportionately affect female-headed households and elderly farmers. Respondents also identified significant challenges (mean=3.44) in retaining crop residues for mulch, primarily due to competition with livestock feed needs in this agro-pastoral community. While farmers recognized Pfumvudza's theoretical benefits, they expressed notable reservations (mean=3.19) about its performance in dry conditions, suggesting the technique may be better suited to higher rainfall areas. The consistent need for training and support (mean=3.32) emerged across all data sources, highlighting critical knowledge gaps in proper application methods.

5.1.2 Advantages of implementing Pfumvudza as a conservation agriculture

The study revealed compelling evidence of Pfumvudza's agricultural advantages through multiple data sources. Farmers overwhelmingly agreed (mean=4.69) that the method significantly improves maize yields compared to conventional farming, particularly in low-rainfall conditions. This quantitative finding was corroborated by interviews where participants described observable yield improvements after adoption. The research also found strong consensus (mean=4.59) about Pfumvudza's role in enhancing household food security, with qualitative data revealing how these benefits manifest across different socioeconomic groups. Interestingly, while initial concerns about labor intensity were noted, respondents later recognized the method's long-term labor efficiency (mean=4.76), suggesting a shift in perception after sustained use. The mulch retention component received moderately strong support (mean=3.88), though follow-up interviews revealed this was often compromised by practical implementation challenges.

5.1.3 Challenges faced by farmers in implementing Pfumvudza as a conservation measure

The research uncovered multiple systemic barriers to Pfumvudza adoption through comprehensive data analysis. Farmers strongly agreed (mean=4.67) that benefits take too long to materialize, creating a critical challenge for food-insecure households that require immediate returns. This quantitative finding was expanded upon in qualitative interviews, where participants described how this time lag discourages adoption. Maintaining permanent soil cover proved particularly problematic (mean=4.37), with field observations confirming how communal grazing practices undermine conservation efforts. The study also revealed significant gender disparities, with female-headed households reporting greater difficulties (mean=3.58) in adopting the method due to its labor demands. Additional challenges emerged around weed control (mean=3.73), with many farmers citing limited access to appropriate herbicides.

5.1.4 Strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe

Findings from qualitative data highlighted the need for safeguards against elite capture. Agricultural extension officers unanimously emphasized the urgency of localized input solutions, particularly drought-tolerant seeds and alternative mulch materials. Training approaches emerged as a contentious issue, with most stakeholders advocating for simplified protocols using visual aids, while others cautioned against oversimplification. Water management integration received strong endorsement, with field-tested recommendations for modifying planting basins. The

grazing conflict solutions generated the most debate, reflecting the complex interplay between agricultural and pastoral needs. All data sources converged on the critical need for long-term institutional support, with particular emphasis on policy stability and consistent extension services.

5.2 Conclusions

5.2.1 Characteristics of Pfumvudza as a conservation method in agriculture

The study sought to comprehensively analyze the adoption characteristics of Pfumvudza in Ward 4 through mixed-methods research. It was concluded that while the conservation agriculture technique demonstrates theoretical potential, its practical implementation faces substantial barriers related to labor requirements, ecological suitability, and knowledge dissemination. The research revealed how these adoption characteristics vary significantly across different farmer demographics and agroecological conditions. Therefore, the objective of assessing Pfumvudza's adoption characteristics was achieved.

5.2.2 Advantages of implementing Pfumvudza as a conservation agriculture

The research aimed to systematically evaluate the advantages of Pfumvudza implementation through multiple analytical lenses. It was concluded that the method offers scientifically validated benefits for yield improvement and food security, particularly in climate-vulnerable regions. However, these advantages are often mediated by contextual factors including rainfall patterns, soil types, and implementation fidelity. The study further established that perceived benefits evolve over time as farmers gain experience with the technique. Therefore, the objective of evaluating Pfumvudza's advantages was successfully accomplished.

5.2.3 Challenges faced by farmers in implementing Pfumvudza as a conservation measure

The study sought to thoroughly investigate the challenges in implementing Pfumvudza through empirical research. It was concluded that adoption barriers are multidimensional, encompassing technical, socioeconomic, and institutional dimensions. These challenges interact in complex ways, often creating compounding effects that discourage sustained use. The research particularly highlighted how existing land use systems and gender dynamics create disproportionate barriers for certain farmer groups. Therefore, the objective of examining implementation challenges was fully achieved.

5.2.4 Strategies for improving Pfumvudza to famers in dry prone areas in Zimbabwe

The research aimed to develop evidence-based strategies for improving Pfumvudza adoption through participatory action research. It was concluded that effective solutions require integrated approaches that address both technical agricultural challenges and broader social considerations. The study generated context-specific recommendations that balance scientific principles with practical feasibility, while accounting for local resource constraints. These strategies emphasize the importance of adaptive management and continuous learning in conservation agriculture programming. Therefore, the objective of proposing improvement strategies was successfully attained.

5.3 Recommendations

- Agricultural extension services need to develop tiered training programs incorporating visual aids and practical field demonstrations. These programs should be tailored to accommodate varying literacy levels among farmers while preserving the scientific principles of Pfumvudza. Such an approach would effectively bridge the knowledge gaps identified during the study.
- Local authorities should initiate processes to establish community grazing agreements that protect mulched fields while meeting livestock needs. This could involve developing by-laws that strike a balance between conservation agriculture requirements and traditional livestock husbandry practices prevalent in Ward 4, Zvimba District.
- Input distribution programs should prioritize context-appropriate solutions including drought-tolerant seed varieties and alternative mulch materials that don't compete with livestock feed requirements. These inputs should be selected based on their suitability for the specific agro-ecological conditions of the area.
- Pilot labor-sharing initiatives should be implemented with built-in safeguards to ensure fair participation, particularly for vulnerable groups such as female-headed households. These models should be designed to prevent elite capture and ensure benefits reach all farmer categories.
- Government agencies and development partners must commit to multi-year support programs, recognizing that meaningful adoption requires long-term engagement. Concurrently, robust monitoring systems should be established to track adoption rates, measure impacts, and identify emerging challenges requiring intervention.

- To enhance Pfumvudza's drought resilience, agricultural extension programs should incorporate simple water-harvesting techniques, such as contour ridges and infiltration pits, into the system's design. Training should emphasize practical methods for modifying planting basins to capture and retain rainwater, addressing farmers' concerns about dry-spell performance.

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Appendix 1:Letter from department


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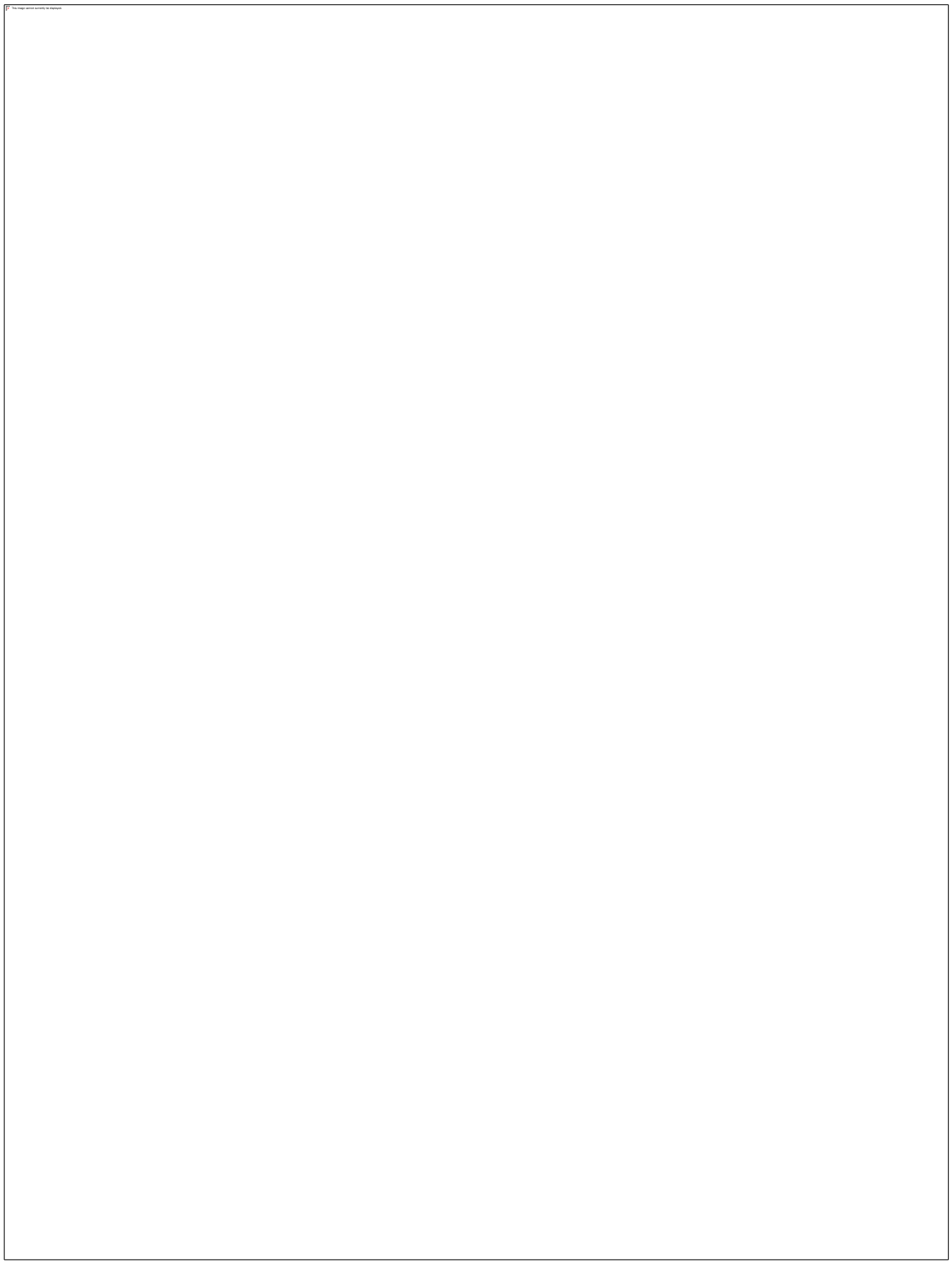
Appendix 2: Approval form



Appendix 3: Standardized Questionnaire

Dear respondent

I am a final year student at Bindura University of Science Education and conducting pure academic research on 'an investigation on the effectiveness of Pfumvudza as a drought resilient strategy in achieving the sustainable development goal (SDG) of zero hunger, the experiences of rural communities in Ward 4, Zvimba district.'. You have been selected to participate in this study and your participation is voluntary and no monetary gain is attached to the exercise. All information will be treated with anonymity and confidentiality. You should not put your name on this questionnaire. Your assistance in completing this questionnaire which solicits your views pertaining to the study will be greatly appreciated.

SECTION 1: Demographic Information *(Tick your response in the space provided)*

	FEATURE					
A1	Gender	Male	Female			
A2	Age	Less than 20 years	21-30	31-40	41-50	50 and above
A3	Years of Experience	1-3 Years	4-6 Years	6 Years and Above		
A4	Education Level	Primary	Secondary	Tertiary	Technical	

SECTION 2: Characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district, Ward 4, Zimbabwe.

To what extent do you agree or disagree that the following statements regarding characteristics of Pfumvudza as a conservation method in agriculture in Zvimba district, ward 4, Zimbabwe.

Key: 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Characteristics Indicators	**1**	**2**	**3**	**4**	**5**
CP1	Pfumvudza is too labour-intensive for most smallholder farmers in Zimbabwe.					

CP2	Keeping crop residues for mulch in Pfumvudza is difficult due to competition with livestock feed.					
CP3	Pfumvudza works better in high-rainfall areas than in dry regions of Zimbabwe					
CP4	Farmers need continuous training and support to successfully practice Pfumvudza.					

SECTION 3: Advantages of implementing Pfumvudza as a conservation agriculture in Zvimba District, Ward 4, Zimbabwe.

To what extent do you agree or disagree with the following statement regarding the advantages of implementing Pfumvudza as a conservation agriculture in Zvimba District, Ward 4, Zimbabwe.Key: 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Advantages Indicators	**1**	**2**	**3**	**4**	**5**
AP1	Pfumvudza requires less labor than conventional tillage, making it more accessible to women and elderly farmers.					
AP2	Pfumvudza significantly improves maize yields in low-rainfall areas compared to conventional farming methods.					
AP3	Farmers practicing Pfumvudza experience improved household food security after adoption.					
AP4	The mulch retention in Pfumvudza reduces soil water evaporation and enhances drought resilience.					

SECTION 4: Challenges faced by farmers in implementing Pfumvudza as a conservation measure in Zvimba District, Ward 4, Zimbabwe.

To what extent do you agree or disagree that the following statements in line with the challenges faced by farmers in implementing Pfumvudza as a conservation measure in Zvimba District, Ward 4, Zimbabwe.Key: 1= Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Challenges Indicators	**1**	**2**	**3**	**4**	**5**
CHA1	Benefits of Pfumvudza take too long to materialize for most smallholder farmers.					
CHA2	Female-headed households face greater difficulties adopting Pfumvudza due to its labor demands.					
CHA3	Lack of access to appropriate herbicides makes weed control difficult in Pfumvudza systems					
CHA4	Communal grazing practices make it impossible to maintain permanent soil cover in Pfumvudza fields.					

Appendix 4: Interview Guide

I am a final year student at Bindura University of Science Education and conducting pure academic research on ‘an investigation on the effectiveness of Pfumvudza as a drought resilient strategy in achieving the sustainable development goal (SDG) of zero hunger, the experiences of rural communities in Ward 4, Zvimba district.’. You have been selected to participate in this study and your participation is voluntary and no monetary gain is attached to the exercise. All information will be treated with anonymity and confidentiality.

Question 1: *Can you describe your experience with the labor demands of this method? What specific tasks are most challenging?*

Question 2: *Since adopting Pfumvudza, how has it impacted your household’s food security? Any seasons where it made a clear difference?*

Question 3: What are some of the common challenges faced by farmers in implementing Pfumvudza as a conservation measure?

Question 4: What practical modifications could make Pfumvudza more effective in Ward 4?

Question 5**:** How can we solve the crop residue dilemma - balancing livestock feed needs with soil cover requirements?

Question 6: What support systems would help you persist through Pfumvudza's challenging transition years?

Question 7: Which labor-saving innovations could make Pfumvudza more manageable in our context?

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