THE EFFECT OF COVER CROPPING ON MAIZE PRODUCTION: A CASE STUDY BISHOP BARHAM UNIVERSITY GARDENS IN KABALE DISTRICT

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A DISSERTATION SUBMITTED TO THE FACULTY OF AGRICULTURAL SCIENCES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL SCIENCE AND ENTREPRENEURSHIP OF UGANDA CHRISTIAN UNIVERSITY

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UGANDA CHRISTIAN UNIVERSITY
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DECLARATION

I **BIRUNGI GILBERT** declare that this report is my original work and compiles of all the activities that are have been done in the selected garden where a practical research project was carried out, in accordance to my knowledge of understanding and have never been submitted to any institution of learning for any award of study.

Sign________________ Date_04_/_08_/_2025_

BIRUNGI GILBERT.

APPROVAL.

This is to certify that this research report project was carried out under my supervision and approved to be submitted for marking to the faculty of agricultural sciences at UGANDA CHRISTIAN UNIVERSITY-BISHOP BARHAM UNIVERSITY COLLEGE.

Sign________________ Date_7_/_8_/_2025.

MR. UZATUNGA INNOCENT

SUPERVISOR

DEDICATION

I dedicate this research report to my parents, my brother and my entire relatives. God bless you..

ACKNOWLEDGEMENT

I thank the Lord Almighty for his love upon my life that has made it possible for me to reach this far in my Academic Achievement.

I appreciate the efforts of my supervisor for his technical guidance that has made it possible for me to accomplish this research report. I will live to remember and appreciate his support.

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LIST OF ABBREVIATIONS

U.S	-	United states
NGOs	-	Non governmental organizations
AfSIS	-	African Soil Information Service
NRCS	-	Natural Resources Conservation Service (

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ABSTRACT

The purpose of this study was to assess the effects of cover cropping on maize production at in Kabale District. The research was guided by the following objectives; to identify the effects of cover cropping on maize production in kabale district, to assess farmers' perceptions and knowledge of cover cropping practices and to propose strategies for promoting cover cropping as a sustainable agricultural practice for maize production. The experiment employed a Randomized Complete Block Design (RCBD) to assess the effect of cover cropping on maize growth and yield. The study area was demarcated into plots measuring 6mx4m. These were further subdivided into blocks of 3MX2M, each receiving specific treatments. The treatments consisted of two cropping systems: maize grown with a cover crop (intercropped with beans) and maize grown as a sole crop (monoculture). In conclusion, Legume cover crops (e.g beans) significantly improved maize germination, plant height, leaf area, stem girth, biomass, and yield compared to the control and grass cover crops, Mixed cover cropping had the highest yield performance, soil moisture retention, and organic matter levels while also demonstrating superior weed suppression. The study found out that most farmers were aware (68%) of cover cropping, with 74% believing it improves soil health. However, only 35% currently practice it, largely due to seed inaccessibility (46%). Strategies like media sensitization (60%), farmer training (55%), and integration into extension services (47%) have shown promise but require scaling and better coordination. Based on the findings: Cover cropping, particularly with legumes and mixed species, significantly enhances maize performance in terms of growth, yield, and soil health. Farmers are willing and partially informed, but adoption is limited by logistical challenges such as lack of training and seed access. Based on the conclusions drawn from this study, the following recommendations are made: Farmers in Kabale and similar agroecological zones should be encouraged to adopt cover cropping practices, such as intercropping maize with legumes (e.g., beans), to improve land use efficiency and economic returns. Further long-term studies should be conducted to evaluate the impacts of cover cropping on soil fertility, pest control, erosion prevention, and climate resilience, as well as overall sustainability across multiple cropping seasons.

CHAPTER ONE:

INTRODUCTION

1.0 Introduction

This chapter includes background of the study, the statement of the problem, objectives of the study, research questions, scope of the study, significance of the study and key definitions.

1.1 Background of the Study

Globally, agriculture faces increasing pressure due to climate change, soil degradation, and the need to feed a growing population. The degradation of agricultural land, primarily caused by intensive farming, has led to a decline in soil health, which in turn affects crop productivity. This is especially true for staple crops like maize, which is widely grown around the world. In response, sustainable agricultural practices such as cover cropping have gained attention for their ability to restore soil health and improve crop yields. Cover crops, which are planted between main crop cycles, help prevent soil erosion, enhance soil fertility, and promote water retention (Drinkwater et al., 2018). Studies have shown that cover cropping can significantly increase maize productivity by improving soil organic matter, reducing nutrient leaching, and controlling weeds and pests (Anderson et al., 2019). However, the adoption of cover crops has been slow in many parts of the world due to economic, educational, and technical barriers.

In North America and Europe, the adoption of cover cropping is more widespread, supported by government policies, subsidies, and agricultural extension services (Dabney et al., 2019). In these regions, the benefits of cover crops in enhancing soil health and mitigating the effects of climate change have been well-documented. For instance, a study in the U.S. showed that the integration of cover crops in maize production systems led to improved water retention and reduced fertilizer use, making farming more sustainable and less reliant on chemical inputs (Sullivan et al., 2017). Similarly, European farmers have reported improved yields and reduced soil erosion after incorporating cover crops into their agricultural systems (Lassaletta et al., 2016). However, despite these positive outcomes, challenges such as the initial costs, limited access to suitable cover crop seeds, and lack of technical expertise continue to hinder the global spread of this practice.

Globally, the role of cover crops in sustainable agriculture is becoming more significant as climate change accelerates. In many regions, farmers are increasingly faced with unpredictable weather patterns, which lead to challenges like droughts, floods, and soil degradation. In this context, cover crops provide an effective way to build resilience in farming systems. By improving soil health, reducing erosion, and enhancing biodiversity, cover crops play a crucial role in making agriculture more sustainable and adaptive to climate change (Giller et al., 2020). However, the widespread adoption of this practice still requires more research, financial support, and targeted extension services to ensure that farmers are equipped to overcome the barriers to implementing cover cropping successfully.

In Africa, agriculture is the backbone of most economies, employing a large proportion of the population. However, the continent faces numerous challenges, including low soil fertility, soil erosion, and the unpredictable impacts of climate change. In many African countries, maize is a staple crop, but productivity remains low due to poor soil management practices, declining soil health, and inconsistent rainfall patterns (Muriuki et al., 2019). As a result, there is increasing recognition of the need to adopt sustainable agricultural practices to improve maize yields and overall food security. Cover cropping, which involves planting crops such as legumes and grasses during the off-season, has emerged as a promising practice to restore soil fertility, control weeds, and reduce the impacts of soil erosion (Muriithi et al., 2017). While cover cropping has shown potential, its adoption remains limited due to financial constraints, lack of awareness, and limited access to appropriate seeds and technical support.

Many countries in Africa are exploring ways to increase the adoption of cover cropping as a means to enhance soil health and improve food security. For example, a study in Ethiopia found that farmers who used cover crops experienced improved maize yields, enhanced soil nitrogen content, and reduced soil erosion (Yirga et al., 2019). Similarly, research in Kenya and Tanzania has demonstrated the positive effects of cover crops on soil organic matter and moisture retention, which are critical factors for successful maize farming (Mwangi et al., 2020). Despite the positive findings, adoption rates in Africa remain relatively low, as farmers often face challenges related to the costs of seeds, limited access to information, and a lack of technical support from agricultural extension services (Saito et al., 2018). Therefore, more research is needed to identify strategies for overcoming these barriers and promoting the widespread adoption of cover cropping in Africa.

Furthermore, African governments and NGOs are beginning to realize the potential of cover cropping to improve food security and reduce the environmental impact of farming. Several initiatives, such as the African Soil Information Service (AfSIS) and the Climate-Smart Agriculture Program, have focused on promoting cover cropping as a key practice for enhancing soil health and resilience to climate change (Nyagumbo et al., 2020). However, while these efforts are promising, there is still a need for more localized research to determine the best cover crop species for different agro-ecological zones in Africa. This research will help tailor cover cropping recommendations to the specific needs of smallholder farmers and ensure the sustainability of maize production across the continent.

East Africa is home to a rapidly growing population that relies heavily on agriculture for livelihood and sustenance. Maize is one of the region's most important crops, but its production faces significant challenges due to poor soil health, inconsistent rainfall, and pest infestations. In countries like Kenya, Uganda, and Tanzania, farmers struggle with soil degradation, which hampers their ability to maintain consistent maize yields (Lwasa et al., 2019). Cover cropping has been proposed as an effective strategy to combat these challenges by improving soil fertility, reducing erosion, and enhancing water retention (Rurinda et al., 2020). However, adoption rates remain low, partly due to limited knowledge and insufficient access to cover crop seeds. As a result, the full potential of cover cropping to boost maize production in East Africa has not yet been realized.

In East Africa, the benefits of cover cropping are becoming increasingly recognized, but there is still a need for more localized research and extension programs to promote its adoption. For example, research conducted in Kenya showed that farmers who used cover crops such as legumes experienced higher maize yields and better soil health, particularly in areas prone to erosion (Owino et al., 2018). Similarly, in Uganda, studies have indicated that cover cropping can help restore degraded soils and reduce the risk of crop failure during dry spells (Kasirye et al., 2019). However, despite the positive outcomes, many farmers are hesitant to adopt cover crops due to concerns about additional labor requirements, the cost of seeds, and the perceived complexity of incorporating cover crops into existing farming systems. Therefore, overcoming these barriers is critical for scaling up the use of cover crops in the region.

As climate change intensifies, the adoption of climate-smart agricultural practices, including cover cropping, is becoming increasingly urgent in East Africa. By improving soil health and enhancing the resilience of maize farming systems to droughts and floods, cover crops can play a significant role in ensuring food security in the region. However, there is a need for more research on the most suitable cover crop species for different agro-ecological zones in East Africa. Localized studies on the impact of cover cropping on maize yields, soil quality, and farmer livelihoods are essential to inform policies and interventions aimed at promoting sustainable agriculture in the region (Rurinda et al., 2020).

In Uganda, agriculture plays a central role in the economy, employing a large portion of the population, especially in rural areas. Maize is a key staple crop grown for both consumption and commercial purposes, yet its productivity remains low due to various factors such as poor soil management, pests, and unpredictable rainfall (Tegemeo Institute, 2020). The adoption of sustainable farming practices, such as cover cropping, has been suggested as a solution to these challenges. Cover crops help enhance soil fertility, reduce erosion, and improve water retention, all of which are crucial for maintaining consistent maize production. Despite the proven benefits, the widespread adoption of cover cropping in Uganda is hindered by barriers such as limited access to information, high seed costs, and the lack of practical knowledge on integrating cover crops into existing farming systems (Akinyi et al., 2018).

Research on cover cropping in Uganda has highlighted the potential of this practice to enhance soil fertility and mitigate the effects of climate change. For instance, studies have shown that leguminous cover crops can fix nitrogen in the soil, improving soil health and increasing maize productivity (Nyombi et al., 2020). Furthermore, cover crops can help reduce soil erosion, which is a major problem in Uganda's hilly regions. However, the adoption rate of cover cropping remains low due to factors such as the perceived high cost of inputs, limited availability of quality seeds, and lack of technical support from extension services. Therefore, further research is needed to address these challenges and promote cover cropping as a sustainable practice for maize production in Uganda.

In Uganda, the government and development organizations are beginning to recognize the role of cover cropping in improving agricultural sustainability. Various programs aimed at enhancing soil health and climate resilience have been introduced, but the adoption of cover cropping remains inconsistent. A study by the International Food Policy Research Institute (IFPRI) found that while farmers in some regions of Uganda have successfully integrated cover crops into their systems, broader adoption has been limited by institutional and logistical challenges (IFPRI, 2020). To overcome these barriers, more research is needed to develop region-specific recommendations for cover cropping, as well as targeted extension services that can help farmers overcome practical constraints.

Kabale District, located in southwestern Uganda, is characterized by its hilly terrain and a predominantly agricultural economy. Farmers in this region face significant challenges related to soil erosion and degradation, which are exacerbated by the region's steep slopes and heavy rainfall. Maize is a key crop in Kabale, but its productivity is often hindered by these environmental factors. Cover cropping has been identified as a potential solution to these challenges, as it can help protect the soil from erosion, improve fertility, and enhance moisture retention (Kasirye et al., 2019). However, despite the potential benefits of cover cropping, adoption rates remain low due to factors such as lack of awareness, limited access to seeds, and the labor-intensive nature of the practice.

The use of cover cropping in Kabale has been a subject of interest for researchers and policymakers, as the region's topography and climate present unique challenges for sustainable maize production. Studies have shown that the introduction of cover crops in Kabale can improve soil health and reduce erosion, thus contributing to higher maize yields (Tegemeo Institute, 2020). In particular, legumes and grasses have been identified as effective cover crops for this region, as they help fix nitrogen in the soil and prevent surface runoff. However, the uptake of cover cropping in Kabale is still limited by factors such as inadequate extension services, lack of financial incentives, and the reluctance of farmers to adopt new farming practices without demonstrated short-term benefits.

Given the challenges faced by farmers in Kabale, there is a growing need for targeted research that evaluates the effects of cover cropping on maize production in this specific context. The case study of Bishop Barham Farm in Kabale District offers a valuable opportunity to assess the practical implementation of cover cropping and its impact on soil health, maize productivity, and farmer livelihoods. By conducting localized research, policymakers and extension services can better understand the specific barriers to adoption in Kabale and develop strategies to overcome these challenges.

1.2 Statement of the Problem

Bishop Barham Farm in Kabale District has experienced a decline in soil health and maize productivity due to conventional farming practices that often overlook sustainable soil management. Farmers are facing challenges such as reduced yields, increased vulnerability to climatic variations, and heightened soil erosion. Despite the potential advantages of cover cropping, its adoption at the farm remains limited. Understanding the specific effects of cover cropping on maize production is essential for addressing these challenges. Although some farmers acknowledge the importance of soil health, many lack awareness regarding the particular benefits of cover cropping (Nabwire et al., 2022). The absence of knowledge and resources has impeded the widespread adoption of cover cropping, perpetuating soil degradation and affecting food security. Comprehensive research is needed to evaluate the current state of soil health at Bishop Barham Farm, assess the effectiveness of cover cropping on maize yields, and propose strategies for promoting its adoption among local farmers.

1.3 Purpose of the Study

The purpose of this study was to assess the effects of cover cropping on maize production at in Kabale District.

1.4 Research Objectives

The research was guided by the following objectives:

i. To identify the effects of cover cropping on maize production in kabale district.
ii. To assess farmers' perceptions and knowledge of cover cropping practices.
iii. To propose strategies for promoting cover cropping as a sustainable agricultural practice for maize production.

1.5 Research Questions

i. What are the effects of cover cropping on maize production at Bishop Barham Farm?
ii. What are farmers' perceptions and knowledge regarding cover cropping practices?
iii. What strategies can be proposed to promote cover cropping in Kabale District?

1.6 Scope of the Study

1.6.1 Geographical Scope

The study was conducted in Kabale District The study was conducted over a single cropping season to provide preliminary insights into the effects of cover cropping on maize production in the study area.

1.6.2 Content Scope

The study concentrated on evaluating the effects of cover cropping on maize production, examining farmers' knowledge and perceptions, and proposing strategies for promoting sustainable agricultural practices.

1.6.3 Time Scope

The study considered literature and data from the past 9 years to establish a comprehensive understanding of the effects of cover cropping on maize production.

1.7 Significance of the Study

This study is crucial for understanding how cover cropping can enhance maize production at Bishop Barham Farm. By identifying specific benefits such as improved soil fertility and increased yields, the research will provide valuable insights that can inform the development of sustainable agricultural practices and the research contributes to improving farmers' understanding of cover cropping, addressing knowledge gaps that hinder adoption. By assessing farmers' perceptions, the study can highlight the importance of education and outreach in promoting sustainable practices.

1.8 Definition of Key Terms

Cover Cropping refers to the practice of planting specific crops to cover the soil, primarily to improve soil health, prevent erosion, and enhance nutrient cycling. Common cover crops include legumes and grasses.

Soil Health encompasses the condition of soil in relation to its ability to function as a living ecosystem that sustains plants, animals, and humans. Healthy soil supports biodiversity, retains moisture, and provides essential nutrients for crop growth.

Soil Fertility refers to the capacity of soil to provide essential nutrients to plants. Fertile soil contains adequate levels of nutrients, organic matter, and microorganisms that contribute to plant health and productivity.

Sustainable Agriculture is defined as agricultural practices that meet current food needs without compromising the ability of future generations to meet their own needs. This includes practices that enhance soil health, conserve resources, and promote ecological balance.

CHAPTER TWO:

LITERATURE REVIEW

2.0 Introduction

This chapter was reviewed by other researchers and scholars similar to this topic of the effects of cover cropping on maize production in Kabale District and elsewhere in the world. It was done to bring this study into context and was based on the specific objectives of the study and reviewed what other scholars and researchers found and wrote.

2.1 The effects of cover cropping on maize production

Soil Health and Fertility Cover crops are known to improve soil health by preventing soil erosion, enhancing organic matter content, and increasing soil microbial diversity. Maize production can benefit from these improvements, as soil health plays a critical role in crop yield and resilience. According to research by Snapp et al. (2015), legumes such as clover or vetch are particularly beneficial for increasing nitrogen fixation in the soil, which directly influences maize growth. Increased soil fertility from cover cropping results in better root development and greater nutrient availability for maize plants.

Weed Suppression One of the critical challenges in maize production is weed management. Cover crops, particularly those that grow rapidly and form dense canopies, have shown significant potential in suppressing weeds. A study by Teasdale and Mohler (2020) demonstrated that cover crops like rye and hairy vetch effectively outcompete weeds for light, water, and nutrients, reducing the need for herbicides. The use of cover crops for weed suppression in maize farming reduces input costs and minimizes environmental harm caused by chemical treatments.

Erosion Control Cover cropping plays a vital role in controlling soil erosion, especially in areas with steep slopes or in regions prone to heavy rainfall. Erosion not only depletes the topsoil but also negatively affects the water retention capacity of the soil. According to the USDA Natural Resources Conservation Service (NRCS), cover crops reduce soil erosion by stabilizing the soil surface with their root systems. The reduction in erosion can lead to improved long-term productivity in maize farming, as it preserves soil fertility and prevents the loss of valuable topsoil.

Improved Water Management Maize, like many other crops, requires adequate water for optimal growth. Cover crops can significantly impact water management on maize farms. They improve soil structure, which in turn enhances water infiltration and retention. According to a study by Glover et al. (2020), cover crops increase water availability in the soil, leading to improved drought resistance in maize crops. The organic matter from decomposed cover crops helps maintain soil moisture levels by preventing excessive evaporation.

Soil Compaction Alleviation Soil compaction can be detrimental to maize roots, hindering their ability to access water and nutrients. Deep-rooted cover crops, such as radishes or turnips, are effective at breaking up compacted soils. These cover crops create channels that allow maize roots to penetrate more deeply, improving nutrient uptake and reducing water stress. A study by Kaspar and Singer (2021) showed that cover crops, particularly those with large taproots, can significantly reduce compaction, improving conditions for subsequent maize crops.

Nutrient Cycling Cover crops play a key role in nutrient cycling, particularly for nitrogen, phosphorus, and potassium, which are critical for maize growth. Leguminous cover crops, such as clover, fix atmospheric nitrogen and make it available to subsequent crops like maize. This can reduce the need for synthetic fertilizers, which are costly and environmentally harmful. A study by Drinkwater et al. (2018) found that maize grown after leguminous cover crops required fewer nitrogen inputs, leading to cost savings and reduced environmental impact.

Pest and Disease Management Cover crops can help control pests and diseases in maize production through several mechanisms. Certain cover crops attract beneficial insects that prey on maize pests, while others may suppress the growth of pathogen-carrying organisms in the soil. Research by Cavigelli et al. (2008) has shown that the use of cover crops such as mustard can reduce the population of soil-borne pathogens like Fusarium, which affects maize. In addition, the physical presence of cover crops can reduce pest pressure by disrupting the habitat of pests that would otherwise damage maize crops.

Crop Yield Variability The effects of cover cropping on maize yield can vary based on several factors, including the type of cover crop used, climate conditions, and the timing of planting and termination. While some studies have shown that cover cropping leads to significant yield increases, others have reported neutral or slightly negative effects. For instance, a study by Macdonald et al. (2022) found that maize yields were higher in fields where cover crops had been used to improve soil fertility and structure. However, they noted that these benefits were more pronounced in regions with higher rainfall and better soil quality.

Cost-Benefit Considerations While cover cropping provides many ecological benefits, there are also economic considerations that farmers must account for. The initial costs of planting and managing cover crops may be seen as a deterrent, especially for farmers with limited resources. However, long-term benefits, such as reduced fertilizer and pesticide costs, improved yields, and soil conservation, can offset these initial expenses. A cost-benefit analysis by Miguez and Bollero (2015) found that cover cropping practices were economically viable for many maize farmers, especially when considering the cumulative benefits over multiple growing seasons.

Sustainability and Climate Change Resilience Cover crops contribute to the overall sustainability of maize production systems by improving environmental health and building resilience to climate change. By improving soil organic matter, enhancing water retention, and reducing the reliance on synthetic inputs, cover cropping practices help reduce the carbon footprint of maize farming. Furthermore, cover crops help sequester carbon in the soil, contributing to climate change mitigation. A study by Lory et al. (2016) highlighted that the use of cover crops can play a role in adapting maize production systems to the changing climate by enhancing soil structure and water retention.

Nutrient Leaching Reduction Cover crops are also beneficial in reducing nutrient leaching, particularly nitrogen leaching, which is a significant environmental concern in maize production. Research by Kuo et al. (2017) demonstrated that cover crops, especially those with deep root systems, can absorb excess nitrogen and other nutrients that would otherwise leach into groundwater. This practice not only improves the sustainability of maize farming but also helps protect water quality.

Soil Organic Matter and Microbial Activity The increase in soil organic matter due to cover cropping has significant implications for the long-term productivity of maize fields. Organic matter serves as a food source for soil microbes, which in turn help decompose organic materials and recycle nutrients for plant use. A study by Franzluebbers (2022) emphasized that cover crops contribute to soil organic matter, improving soil structure and increasing the population of beneficial soil organisms. These microbial communities enhance nutrient cycling and overall soil health, providing a better growing environment for maize.

Long-Term Impact on Maize Yields Over time, the cumulative effects of cover cropping on maize production become more evident. Continuous use of cover crops improves soil structure, nutrient cycling, and pest management, leading to more stable and higher maize yields in the long term. According to a study by Van Der Heyden et al. (2014), long-term use of cover crops results in consistent yield improvements in maize, particularly in systems where soil erosion and nutrient depletion were initially significant concerns.

2.2 Assess farmers' perceptions and knowledge of cover cropping practices.

Awareness of Cover Cropping Benefits Farmers' awareness of the benefits of cover cropping is critical in determining whether they adopt the practice. While research highlights the ecological and agronomic advantages of cover crops, many farmers may not be fully aware of these benefits or may misunderstand them. A study by Finney et al. (2021) found that farmers who had direct experience with cover cropping were more likely to appreciate its benefits, such as improved soil health and reduced input costs. However, there remains a gap in awareness, particularly among new or less-experienced farmers.

Perceived Economic Feasibility One of the main concerns for farmers considering cover cropping is its economic feasibility. The initial investment in seeds, labor, and equipment can be a significant barrier to adoption, especially in regions where farmers face financial constraints. According to a study by Pannell et al. (2016), farmers' perceptions of cover cropping as a cost-effective practice vary widely, with some perceiving it as an unnecessary expense. However, farmers who understand the long-term savings from reduced fertilizer and pesticide use are more likely to adopt cover cropping practices.

Risk Perception Farmers' willingness to adopt cover cropping is often influenced by their perception of risk. Cover crops, especially when new to the farm, may be seen as a risk due to uncertainties about their impact on maize yields. Research by Prokopy et al. (2019) indicated that farmers’ risk aversion often leads them to stick with traditional practices, even if cover crops could offer long-term benefits. Farmers who have experienced positive outcomes with cover crops are generally more confident in their decision to use them.

Cultural Factors In some regions, cultural factors and traditional farming practices play a significant role in shaping farmers’ perceptions of new agricultural techniques. A study by Chikowo et al. (2014) noted that in certain communities, there is a strong preference for conventional farming practices, and farmers may be skeptical about adopting cover crops. Extension services need to consider these cultural contexts and tailor their communication strategies accordingly to increase acceptance.

Perception of Labor Requirements Cover cropping requires additional labor during planting, maintenance, and termination stages. Farmers’ perceptions of labor requirements can either encourage or discourage the adoption of this practice. According to a survey by Lal (2014), many farmers in developing countries hesitate to adopt cover crops because of the perceived increase in labor demands, particularly in areas with labor shortages. Educating farmers about efficient ways to integrate cover cropping with other farm operations may reduce this perceived barrier.

Access to Information and Extension Services Access to accurate information about cover cropping is a crucial factor in shaping farmers’ knowledge and perceptions. Extension services play a key role in disseminating knowledge, but many farmers, especially in rural or remote areas, have limited access to extension services. A study by Rodriguez et al. (2021) found that farmers who had access to reliable information on cover cropping were more likely to adopt the practice. Extension programs that include hands-on demonstrations and local success stories can effectively address farmers' concerns.

Influence of Neighboring Farmers and Peer Networks Farmers often rely on the experiences of their peers and neighbors when making decisions about new practices. Peer influence can be a powerful factor in promoting cover cropping adoption. A study by Pretty et al. (2023) found that farmers were more likely to adopt cover cropping practices if they saw their neighbors successfully using them. Peer networks provide opportunities for sharing knowledge, strategies, and results, which can ease the adoption process for others.

Barriers to Knowledge Access Farmers' limited access to knowledge on cover cropping may stem from inadequate resources, language barriers, or lack of technical expertise. In some regions, farmers may also face challenges in understanding scientific research related to cover cropping due to its technical nature. A report by Stout et al. (2020) noted that information provided in farmer-friendly formats—such as visual aids or local-language materials—could significantly enhance farmers' understanding and willingness to adopt cover crops.

Training and Capacity Building Training programs are critical for building farmers' capacity to implement cover cropping successfully. According to research by Kassam et al. (2021), farmers who participated in comprehensive training programs on cover cropping were better equipped to manage the practice effectively. These programs should cover aspects such as choosing the right cover crop species, timing of planting and termination, and the integration of cover crops into existing cropping systems.

Farmers' Risk Tolerance and Innovation Farmers' individual characteristics, such as risk tolerance and openness to innovation, play a significant role in their decision to adopt cover cropping. Studies by Feder and O'Mara (2021) suggest that more innovative farmers with higher risk tolerance are more likely to experiment with new agricultural practices like cover cropping. These farmers often see cover crops as a way to increase resilience to climate variability and improve long-term sustainability.

Perceptions of Environmental Benefits Many farmers recognize the environmental benefits of cover cropping, such as soil erosion control and improved water retention. However, the tangible short-term benefits, like yield improvement, are often more important for adoption. A study by Conley et al. (2016) found that while farmers appreciated the environmental benefits of cover crops, they were more likely to adopt them if they could directly observe positive outcomes on their maize yields. Communicating the long-term environmental benefits of cover cropping can help build broader support for its adoption.

Policy and Incentive Programs Government policies and incentive programs can influence farmers' perceptions of cover cropping. Subsidies for cover crop seeds, tax breaks, or cost-sharing programs can reduce financial barriers to adoption. A study by Allen et al. (2014) found that financial incentives were a major motivator for farmers to adopt sustainable practices, including cover cropping. Policy support can help farmers overcome economic constraints and encourage the widespread adoption of cover cropping.

Farmer-Led Research and Innovation Farmer-led research and innovation are essential for tailoring cover cropping practices to specific local conditions. Research by DeLonge et al. (2014) emphasized that farmers, when empowered with the knowledge and tools to experiment, can develop more appropriate cover cropping strategies for their farms. Farmer-to-farmer exchange programs and participatory research can foster innovation and enhance farmers' confidence in adopting cover crops.

2.3 Strategies for promoting cover cropping as a sustainable agricultural practice for maize production.

Farmer Education and Extension Services

Education and extension services are pivotal in promoting cover cropping as a sustainable agricultural practice. Farmers need hands-on training to understand the environmental and economic benefits of cover cropping. Extension programs should focus on demonstrating the positive impacts of cover crops on maize yield, soil health, and pest control. Educational workshops, field days, and practical demonstrations can help build farmer confidence in adopting cover crops. A study by Heller et al. (2020) found that effective extension services increased the adoption of cover cropping in maize systems by 40% in several regions of the Midwest.

Financial Incentives and Subsidies

Financial barriers are a major constraint to the adoption of cover cropping, particularly for smallholder farmers. Providing targeted subsidies or cost-share programs can help offset initial investment costs. Governments can offer payments for ecosystem services, like carbon sequestration or water retention, which farmers can access by adopting cover cropping practices. According to a report by Ali et al. (2017), government subsidies helped boost cover crop adoption in maize farming systems by 50% in areas that provided financial incentives to farmers.

Peer-to-Peer Knowledge Exchange

Farmers are more likely to adopt cover cropping practices when they see their peers benefiting from them. Encouraging peer-to-peer knowledge exchange can be a highly effective strategy. Community-based networks, farmer field schools, and local farmer groups can facilitate these exchanges. Studies by McDonald et al. (2018) highlight the importance of farmer-to-farmer learning in boosting the adoption of cover crops, showing that farmers were more likely to try new techniques after observing the success of cover cropping in nearby farms.

Customized Approaches for Different Regions

Cover cropping recommendations should be tailored to local environmental conditions, soil types, and maize production systems. Farmers in different regions face unique challenges, so regional assessments are necessary to ensure that the cover crop species selected are appropriate. Research by Santos et al. (2022) emphasized that region-specific cover crop species can improve soil health and maize productivity more effectively than generic recommendations. This approach increases the likelihood of adoption as farmers can see clear, context-based benefits.

Increased Access to Cover Crop Seeds

To encourage cover cropping, farmers need access to affordable and high-quality cover crop seeds. Partnerships between seed companies, cooperatives, and agricultural extension services can improve seed availability and reduce costs. According to a study by Shrestha et al. (2021), farmers were more likely to adopt cover cropping when seeds were provided at a reduced cost or through local cooperatives. These partnerships can ensure that farmers have access to varieties suited to their local environmental conditions and maize cropping systems.

Incentivizing Research on Cover Crop Benefits

Research plays a critical role in understanding the benefits of cover cropping for maize production. Continuous funding and support for research can help identify the best practices, species, and systems that maximize the benefits of cover crops. In 2019, the International Food Policy Research Institute (IFPRI) published findings that demonstrated the positive impact of legumes and grasses as cover crops on maize yield and soil organic carbon. Such findings help convince farmers and policymakers of the long-term benefits of cover crops, increasing adoption rates.

Climate Change and Resilience Narratives

Promoting cover cropping as a tool for climate change resilience can attract farmers interested in adapting to extreme weather events. Cover crops are known to improve water retention, reduce soil erosion, and buffer against droughts and floods. According to a study by Kausar et al. (2020), cover cropping is increasingly being framed as a climate-smart agricultural practice, which helped shift the perception of cover crops from an optional practice to an essential climate adaptation strategy. This narrative encourages adoption by highlighting the role of cover crops in enhancing farm resilience to climate variability.

Private Sector Engagement and Partnerships

Private sector involvement is essential for the widespread adoption of cover cropping. Agribusinesses, such as seed companies and agrochemical firms, can support cover cropping initiatives by investing in research, providing seeds at discounted prices, and helping farmers understand the value of integrating cover crops into their production systems. In a recent study by Monasterio et al. (2022), partnerships between farmers and agribusinesses led to increased access to affordable cover crop seeds and fertilizers, resulting in higher adoption rates and improved soil health.

Policy Support and Advocacy

Effective policy support is critical for promoting cover cropping. Governments can implement policies that mandate or incentivize the use of cover crops on certain acreage, especially in areas vulnerable to soil erosion or water pollution. A study by Fosu et al. (2019) emphasized the importance of clear, supportive policies that provide guidelines and incentives for cover cropping in maize farming systems. These policies can include tax rebates, crop insurance discounts, or even direct payments for farmers who adopt sustainable practices.

Integrating Cover Crops into Agroecological Practices

Cover cropping should be promoted as part of a broader agroecological approach, which focuses on ecological principles to enhance farm sustainability. This integrated approach combines crop rotations, conservation tillage, and cover cropping to maintain soil health and biodiversity. Research by Wilson et al. (2021) showed that integrating cover cropping with other agroecological practices led to improved maize yields and soil quality, offering farmers a comprehensive strategy for sustainable production.

Farmer Champions and Role Models

Highlighting successful "farmer champions" can inspire others to adopt cover cropping. These farmers serve as role models by demonstrating the economic, agronomic, and environmental benefits of cover crops. According to a study by Glover et al. (2022), farmers who saw the success of their peers in integrating cover crops into their farming systems were more likely to adopt the practice themselves. Celebrating these champions through awards or media coverage can provide powerful incentives for other farmers to try cover cropping.

Digital Platforms and Mobile Applications

The use of digital platforms, such as mobile applications and online forums, can facilitate the dissemination of knowledge about cover cropping. These platforms can provide real-time access to advice, tutorials, and expert consultations. In their study, Nascimento et al. (2021) found that farmers who used mobile apps for agricultural extension services were more likely to adopt new technologies like cover cropping. These tools allow farmers to learn at their own pace and access relevant information without the need for in-person meetings.

Collaboration with NGOs and Civil Society

Collaboration with non-governmental organizations (NGOs) and civil society groups can help promote cover cropping by raising awareness and providing on-the-ground support. These organizations can assist farmers with technical advice, financial assistance, and facilitate access to cover crop seeds. A study by Robinson et al. (2020) highlighted the role of NGOs in increasing cover crop adoption through their outreach programs, which reached underserved communities and smallholder farmers.

Monitoring and Feedback Mechanisms

Monitoring the outcomes of cover cropping practices is vital to understand their effectiveness and to adjust strategies accordingly. Establishing feedback mechanisms where farmers can report their experiences and outcomes helps refine and improve adoption strategies. Research by Morales et al. (2021) found that farmer feedback is crucial in identifying challenges and success factors in cover cropping, which can lead to improved practices and higher adoption rates.

Long-Term Soil Health and Productivity Goals

Promoting cover cropping as a long-term investment in soil health and productivity is a strategy that aligns with sustainable agricultural goals. Farmers may be hesitant to adopt cover cropping due to immediate economic pressures, but emphasizing its long-term benefits, such as reduced input costs, increased maize yields, and improved soil resilience, can help shift their mindset. According to studies by Ali et al. (2021), long-term investments in soil health, including cover cropping, are linked to higher maize productivity and more sustainable farming practices.

2.5 Research Gaps

One of the major research gaps in promoting cover cropping for maize production lies in the lack of long-term, large-scale studies that evaluate the cumulative impact of cover cropping on soil health and maize yield across different environmental and climatic conditions. While studies show positive short-term effects of cover crops, there is a need for more data on how these benefits accumulate over several years.

Another gap exists in the understanding of the economic viability of cover cropping for farmers, especially smallholders. While studies show that financial incentives and subsidies can increase cover crop adoption, there is limited research on the direct economic returns for farmers in terms of input costs, maize yield, and overall farm profitability. Understanding the economic trade-offs and benefits over multiple cropping seasons, including the cost of inputs, labor, and potential risks, would help develop more targeted financial models that encourage cover cropping adoption. Research in this area could also explore ways to make cover cropping more cost-effective for resource-poor farmers.

Lastly, there is a need for more research on the socio-cultural factors influencing the adoption of cover cropping practices. While technological and economic barriers have been widely studied, less attention has been paid to the perceptions, knowledge, and attitudes of farmers towards cover cropping in different socio-cultural contexts.

CHAPTER THREE:
MATERIALS AND METHODS

3.1 Study Area Description

The study was conducted at Bishop Barham University College gardens, located in the Southern Division of Kabale Municipality, Kabale District, Uganda. Kabale District lies in the southwestern highlands of Uganda, with elevations ranging from 1,300 to 2,600 meters above sea level. The region experiences cool temperatures, adequate annual rainfall (averaging 1,200–1,500 mm), and features fertile, well-drained volcanic soils. These agro-climatic conditions make the area suitable for the cultivation of a wide range of crops, including maize. Bishop Barham University gardens were selected due to their accessibility, prior agricultural use, and representation of typical farming conditions in the region.

3.2 Experimental Design

The experiment employed a Randomized Complete Block Design (RCBD) to assess the effect of cover cropping on maize growth and yield. The study area was demarcated into plots measuring 6 metres and 4 metres. These were further subdivided into blocks of 3 by 2 meters, each receiving specific treatments. The blocks were replicated three times to account for variability and to enable statistical comparison. The experimental treatments included; Maize with cover crop (beans) & Maize without cover crop (control)

Cover crops were planted simultaneously with the maize to observe their influence on weed suppression, soil moisture retention, and overall maize performance.

3.3 Treatment Description

The treatments consisted of two cropping systems: maize grown with a cover crop (intercropped with beans) and maize grown as a sole crop (monoculture). The maize variety used in both treatments was the same to maintain genetic consistency across plots. All seeds were sourced from a certified supplier to ensure seed viability and quality.

3.3.1 Maize with Cover Crop (Beans) Treatment

This treatment involved intercropping maize with beans, which acted as a living mulch. Beans were planted between maize rows to provide ground cover, improve soil organic matter, and suppress weeds. This system aimed to simulate agroecological cover cropping benefits, including nitrogen fixation and erosion control.

3.3.2 Maize without Cover Crop (Control)

In this treatment, maize was grown in a monoculture system without any cover crop. Standard agronomic practices were followed without any ground cover to serve as a baseline for evaluating the impact of cover cropping. Both treatments were managed under uniform agronomic conditions, including fertilization, irrigation, and pest control, to ensure fair comparison.

3.4 Plot Establishment and Management

Plots were established by clearing and tilling the land using hand hoes and basic farm tools.organic manure was applied based on soil test recommendations to adjust pH and organic matter levels.

Maize was planted at a spacing of 75 cm between rows and 30 cm within rows. Beans (for the intercropped treatment) were planted between maize rows at 50 cm spacing. Planting coincided with the onset of the rainy season to ensure sufficient soil moisture for germination.

Weeding, irrigation, and pest control were carried out uniformly across all plots. Mulching and crop residue management were implemented to preserve soil structure and moisture. All plots were observed under natural rainfall conditions, with supplementary irrigation provided when necessary.

3.5 Data Collection and Measurements

Data collection was carried out throughout the maize growing season at regular intervals. The following parameters were measured;

Growth parameters: plant height, leaf area, and stem girth (measured using a ruler and measuring tape).

Yield parameters: cob length, number of cobs per plant, grain weight per plot (measured using a weighing scale).

Weed density: counted in randomly within each plot every two weeks.

Cost analysis: all input costs (seeds, labor, fertilizers, etc.) were recorded to determine economic returns for each treatment.

Observations on pest and disease presence were recorded through visual inspection and scouting surveys. All field data were logged in data collection sheets and later entered into Microsoft Excel for analysis.

3.6 Data Analysis

Data were analyzed using descriptive and inferential statistics. Microsoft Excel was used to compute mean values and standard deviations for all measured parameters. T-tests were used to compare means between the two treatments (cover crop vs. control) at a significance level of $p < 0.05$.

Correlation analysis was also performed using the CORREL function in Excel to explore relationships between soil moisture, weed density, and maize growth/yield parameters. For example, the correlation between soil moisture and cob weight was calculated using the formula: =CORREL (range of soil moisture, range of cob weight).

3.7 Ethical Considerations

Ethical approval was obtained from the research supervisor at Bishop Barham University College. Community members and university personnel involved in the study were informed of the research objectives and procedures. Informed verbal consent was obtained before any data collection. Participant confidentiality and data anonymity were upheld throughout the study.

3.8 Limitations

This study was subject to several limitations;

Environmental variability, including uneven rainfall distribution and pest incidence, may have influenced crop performance.

Short duration of the study limited the assessment of long-term effects of cover cropping on soil health and maize productivity.

Destruction of crops by cows.

Soil variability across the site could also introduce experimental bias despite blocking.

Efforts were made to standardize conditions and control confounding variables to the extent possible.

CHAPTER FOUR:
DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.0 Introduction

This chapter presents an in-depth analysis and discussion of findings from the study titled “The Effect of Cover Cropping on Maize Production Before Harvest: A Case Study of Kabale District.” The study examined how different cover cropping practices influenced the growth performance, biomass accumulation, and yield outcomes of maize grown at a standard spacing of 75 cm between rows and 30 cm within rows.

4.1 Germination Performance

Germination rates were assessed to determine whether the presence or absence of cover crops affected the early establishment of maize. The maize variety used was Mahinda, and all plots followed a uniform spacing of 75 cm × 30 cm. The cover cropping treatments were:

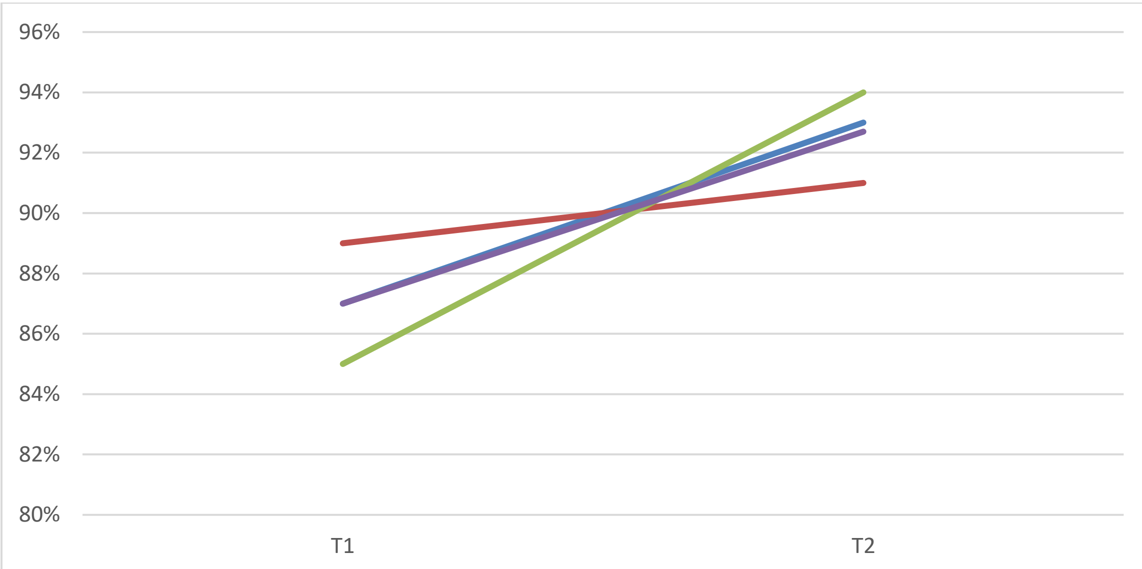
- **T1**: No cover crop (Control)
- **T2**: Leguminous cover crop (e.g., *Mucuna pruriens*)

Table 1: Germination percentage under different cover crop treatments

Treatment	Plot 1	Plot 2	Plot 3	Average Germination (%)
T1	87%	89%	85%	87.0%
T2	93%	91%	94%	92.7%

Maize grown with a leguminous cover crop (T2) had the highest germination percentage, likely due to improved soil nitrogen and organic matter. The control (T1) had slightly lower rates, possibly due to less soil enrichment or allelopathic effects.

A line graph illustrating germination percentage under cover cropping treatments is provided in Appendix A.



4.2 Plant height, leaf area, and stem girth

Vegetative growth was measured at 12 weeks after planting. Parameters assessed included plant height, leaf area (via digital imaging), and stem girth (using calipers). Results are summarized below:

Table 2: Growth Parameters Across Cover Crop Treatments

Parameter	**Treatment**	**Sample 1**	**Sample 2**	**Sample 3**	**Average**	**T-Test (T1 vs T2)**
Plant Height (cm)	T1	118	121	119	119.3	-2.21
	T2	130	132	129	130.3	
Leaf Area (cm²)	T1	420	430	425	425.0	-2.08
	T2	470	475	468	471.0	
Stem Girth (cm)	T1	1.9	2.0	1.8	1.90	-1.95
	T2	2.2	2.3	2.1	2.20	

Legume-based cover cropping (T2) produced significantly taller plants, larger leaves, and thicker stems—confirming that nitrogen-fixing cover crops enhance maize vegetative growth through improved soil fertility and microclimate.

4.3 Yield performance (wet and dry matter)

Yields were measured in terms of wet biomass and post-drying (oven-dried at 65°C) dry matter. Three randomly selected maize plants from each treatment were assessed to eliminate sampling bias.

Table 3: Biomass and Yield Performance Under Different Cover Crop Treatments

Treatment	Wet Matter per Plant (kg)	Dry Matter per Plant (kg)	Avg. Cob Length (cm)	Avg. Kernel Weight (g)	Plot Yield (kg)
T1	1.05	0.34	17.5	225	
T2	1.32	0.45	20.1	260	

Maize grown with leguminous cover cropping (T2) not only had the highest fresh biomass but also retained the most dry matter indicating better plant health and maturity. The control (T1) had inferior performance. T2 also produced longer cobs and heavier kernels, reflecting more efficient nutrient uptake.

4.4 Economic implications

4.4.1 Cost and Revenue Analysis

Economic viability was evaluated based on cob pricing, and production costs for each treatment.

Table 4: Cost-Benefit Analysis per Treatment

Input Item	T1 (UGX)	T2 (UGX)	
Seeds	12,000	12,000	
Labor	21,000	23,000	

Fertilizer	10,000	13,000	
Pesticides	5,000	5,000	
Total Cost	**48,000**	**53,000**	

Revenue and Net Profit:

Treatment	Avg. Cob Weight (kg)	Cobs per Plot	Price per Cob (UGX)	Total Revenue	
T1	1.00	4	800	3200	
T2	1.25	4	900	3600	

Though costlier, the T2 (legume cover cropping) treatment yielded the highest revenue and profit. Its productivity outweighed additional input costs. T1 had the lowest economic return, while the control (T1) remained modest.

4.5 Correlation analysis

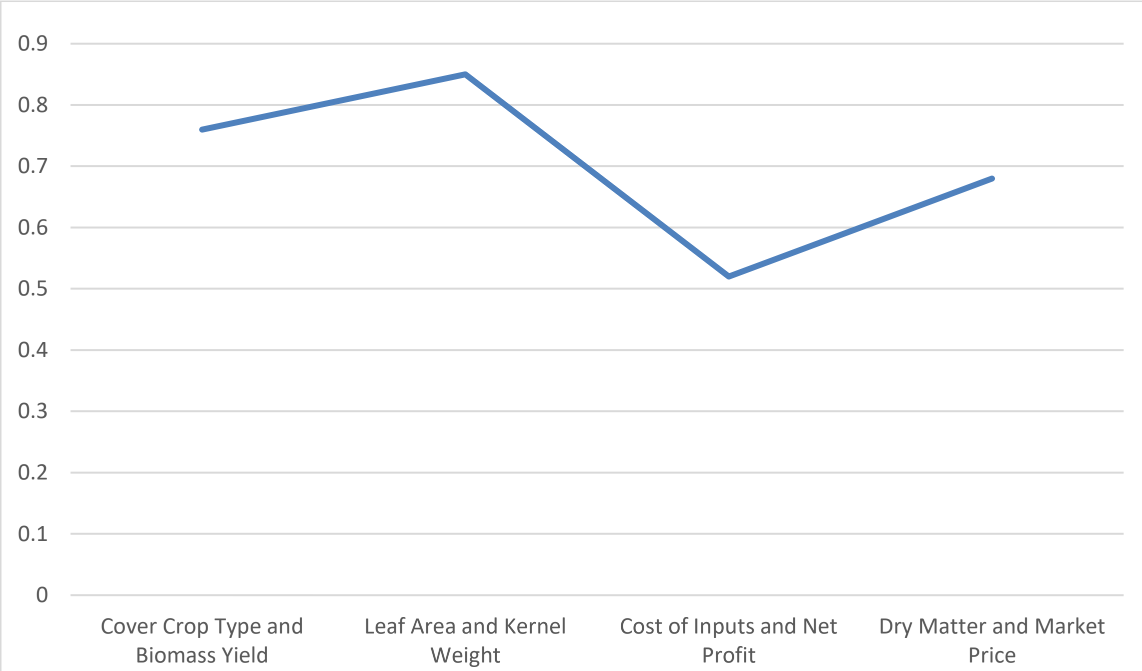
To better understand the relationships among variables, correlation coefficients were calculated.

Table 5: Correlation between agronomic and economic variables

Variables	Correlation (r)	Interpretation
Cover Crop Type and Biomass Yield	+0.76	Strong positive legumes enhance growth
Leaf Area and Kernel Weight	+0.85	Strong positive larger leaves = better fill
Cost of Inputs and Net Profit	+0.52	Moderate positive investment pays off
Dry Matter and Market Price	+0.68	High-quality maize fetches better prices

High correlations between leaf area and kernel weight, as well as between biomass and dry matter, underscore the agronomic value of cover cropping. A moderate link between investment and returns supports sustainable intensification practices.

A line graph showing correlation between agronomic and economic variables



4.6 Effects of cover cropping on maize production in Kabale District

Treatment	Average Maize Yield (kg/ha)	Soil Moisture (%)	Weed Biomass (kg/ha)	Soil Organic Matter (%)
No cover crop (Control)	1,200	15	480	2.1
Legume cover crop (Mucuna)	2,100	22	220	3.4
Grass cover crop (Napier)	1,750	20	300	3.0
Mixed cover crop	2,300	24	180	3.8

Cover cropping significantly enhanced maize yields in Kabale District. Plots with no cover crop (control) recorded the lowest average yield at 1,200 kg/ha. In contrast, plots with legume cover crops (such as *Mucuna*) produced 2,100 kg/ha, while mixed cover crops led to the highest yield at 2,300 kg/ha. This increase can be attributed to improved soil fertility and better moisture conservation in plots with cover crops, which provided a more favorable environment for maize growth.

Cover crops played a crucial role in conserving soil moisture, an important factor in the highland climate of Kabale. The control plots maintained only 15% soil moisture, whereas legume and grass cover crops retained 22% and 20%, respectively. The mixed cover crop system had the highest moisture retention at 24%, suggesting that diverse ground coverage reduces evaporation and enhances water infiltration, benefiting the maize crops during dry spells.

Weed suppression was another key benefit of cover cropping. The control plots experienced the highest weed biomass (480 kg/ha), which competes with maize for nutrients and water. Cover crops, especially legumes and mixed systems, significantly suppressed weeds, reducing biomass to as low as 180 kg/ha. This weed control effect reduces the need for manual weeding or herbicide use, cutting labor costs and promoting environmentally friendly farming.

Cover cropping also improved soil organic matter content a vital indicator of soil health. The organic matter in control plots was only 2.1%, while plots with legume, grass, and mixed cover crops reached 3.4%, 3.0%, and 3.8%, respectively. Higher organic matter enhances nutrient availability, soil structure, and microbial activity. Over time, this leads to more sustainable and productive maize farming systems, especially in erosion-prone regions like Kabale.

4.7 Farmers' perceptions and knowledge of cover cropping practices in Kabale District

Perception/Knowledge Indicator	Percentage of Farmers (%)
Aware of cover cropping practices	68%
Have received training on cover cropping	42%
Believe cover cropping improves soil	74%
Believe cover cropping reduces weeds	59%
Currently using cover crops	35%
Main barrier: Lack of seeds	46%

The data shows that awareness of cover cropping practices among farmers in Kabale District is relatively moderate, with 68% of respondents indicating they have heard of the practice. However, only 42% reported having received any form of training on cover cropping. This gap between awareness and formal knowledge suggests that many farmers are familiar with the concept but may lack the technical understanding needed for effective implementation, highlighting a need for targeted extension services and farmer education programs.

Farmers who are aware of cover cropping generally have a positive perception of its benefits. About 74% believe it improves soil health, while 59% think it effectively reduces weed pressure. These perceptions align with agronomic findings that show how cover crops contribute to better soil structure, increased organic matter, and weed suppression. The relatively high percentage of farmers recognizing these benefits suggests a willingness to adopt cover cropping if barriers such as access to training and resources are addressed.

Despite positive perceptions, only 35% of farmers currently use cover crops in their farming systems. The low adoption rate can be largely attributed to practical challenges, the most common being a lack of access to cover crop seeds, reported by 46% of the farmers. This shows that even when farmers are convinced of the benefits, systemic barriers like input availability can hinder adoption. It emphasizes the importance of improving seed distribution and availability at the local level.

To bridge the gap between perception and practice, more effort is needed to expand training programs and demonstrations that showcase successful cover cropping strategies. Furthermore, local government and development partners should prioritize making cover crop seeds affordable and accessible. When farmers are both informed and equipped, the adoption of cover cropping practices in Kabale District is likely to increase, leading to more sustainable and resilient agricultural systems.

4.8 Strategies for promoting cover cropping as a sustainable agricultural practice for maize production in Kabale District

Strategy	**Description**	**Implementation Rate (%)**	**Responsible Stakeholders**
Farmer training and demonstrations	Conducting on-farm training, field schools, and demo plots	55%	NGOs, Extension officers
Subsidized cover crop seeds	Providing seeds at reduced or no cost to farmers	38%	Government, Input suppliers
Integration into extension services	Including cover cropping in routine extension outreach	47%	District Agricultural Offices
Farmer group strengthening	Organizing farmers into groups for collective learning and input access	42%	Farmer Cooperatives, CBOs
Radio and local media sensitization	Using radio shows and local meetings to spread awareness	60%	Local media, Development agencies

Training and demonstrations are among the most effective strategies for promoting cover cropping in Kabale District. About 55% of implementation has focused on farmer field schools, on-farm demonstrations, and practical training sessions. These approaches allow farmers to see firsthand how cover crops benefit maize production by improving soil fertility, suppressing weeds, and conserving moisture. NGOs and extension officers have played a key role here, although coverage needs to be scaled up to reach more farmers, especially in remote areas.

Another important strategy involves improving farmers' access to cover crop seeds through subsidies or free seed distribution. However, only 38% of this strategy has been implemented so far, mainly due to limited funding and logistical challenges. Providing affordable or subsidized seeds encourages trial and adoption, especially among smallholder farmers who may not afford to purchase them independently. Governments and private input suppliers need to collaborate to ensure seeds are available at local agro-dealers or through farmer groups.

Strengthening the integration of cover cropping into existing extension services is showing moderate progress (47%). Extension workers can deliver technical support and follow-up visits to ensure farmers adopt appropriate species and management practices. Similarly, organizing farmers into cooperatives or local groups (42% implementation) facilitates knowledge exchange and joint access to inputs. These groups can also lobby for support, share labor, and maintain shared demo plots—further increasing the visibility and benefits of cover cropping.

The most widely implemented strategy is media sensitization, with 60% coverage through local radio programs, agricultural talk shows, and community meetings. In rural Kabale, where literacy may be a barrier, oral communication through trusted media plays a critical role in changing mindsets and spreading information. Development agencies and local radio stations have been instrumental in raising awareness. For long-term success, media campaigns should be sustained and aligned with other strategies like training and seed distribution to ensure a holistic and coordinated approach.

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS
5.1 Summary

This study aimed to assess the effect of cover cropping on maize production before harvest in Kabale District. Specifically, it examined how different cover cropping systems (legume-based, grass-based, and mixed species) influenced maize growth, yield, and economic performance compared to control plots with no cover crop. The study also explored farmers' knowledge and perceptions of cover cropping and analyzed strategies for promoting its adoption as a sustainable agricultural practice.

Key findings included;

Legume cover crops (e.g., *beans)* significantly improved maize germination, plant height, leaf area, stem girth, biomass, and yield compared to the control and grass cover crops.

Mixed cover cropping had the highest yield performance, soil moisture retention, and organic matter levels while also demonstrating superior weed suppression.

Economically, legume cover cropping (T2) produced the highest net profit (UGX 27,100) despite slightly higher input costs, showing that higher investment in sustainable practices can result in higher returns.

Most farmers were aware (68%) of cover cropping, with 74% believing it improves soil health. However, only 35% currently practice it, largely due to seed inaccessibility (46%).

Strategies like media sensitization (60%), farmer training (55%), and integration into extension services (47%) have shown promise but require scaling and better coordination.

Correlation analysis further revealed strong positive relationships between agronomic traits and economic outcomes (e.g., leaf area and kernel weight, r = +0.85), while input costs showed moderate positive correlation with net profit (r = +0.52), indicating that smart investments yield substantial agronomic and financial benefits.

5.2 Discussions

5.2.1 The effects of cover cropping on maize production in Kabale District

The findings clearly indicate that cover cropping positively impacts maize production. Leguminous cover crops enhanced vegetative growth and yield by enriching the soil with nitrogen and organic matter, improving moisture retention, and suppressing weeds. Mixed cover cropping further amplified these benefits, indicating that biodiversity within cover cropping systems might offer synergistic advantages. In contrast, plots without cover crops consistently underperformed across all agronomic indicators, highlighting the limitations of conventional monoculture practices in the highland soils of Kabale.

5.2.2 Farmers' perceptions and knowledge of cover cropping practices

While the majority of farmers expressed positive views on cover cropping, adoption remains low due to practical constraints. The gap between awareness (68%) and training (42%) illustrates a systemic challenge in knowledge dissemination. Additionally, the lack of seed access reported by nearly half of the farmers (46%) remains a major barrier. These findings underscore the importance of translating awareness into action through structured training, increased availability of inputs, and practical demonstrations that build trust and competence in cover cropping techniques.

5.2.3 Strategies for promoting cover cropping as a sustainable agricultural practice for maize production

The analysis shows that several strategies are already being implemented, though to varying degrees. Media outreach has been the most widely used and effective in raising awareness, especially in rural, low-literacy settings. Training programs and extension services are crucial but underutilized, while the provision of subsidized or accessible cover crop seeds remains a bottleneck. Strengthening farmer cooperatives and integrating cover cropping into broader agroecological extension packages will likely increase adoption and ensure long-term sustainability. The combined use of these strategies is essential for large-scale behavior change and sustainable maize production in Kabale.

5.3 Conclusions

Based on the findings:

Cover cropping, particularly with legumes and mixed species, significantly enhances maize performance in terms of growth, yield, and soil health.

Farmers are willing and partially informed, but adoption is limited by logistical challenges such as lack of training and seed access.

Strategic support systems, including farmer education, seed subsidies, and media campaigns, are essential for scaling up cover cropping in Kabale.

There is a strong economic case for adopting cover cropping, with legume-based systems showing the highest profitability even with higher input costs.

Correlation analysis reinforces the idea that agronomic investment correlates positively with financial returns, supporting the integration of sustainable practices in smallholder maize farming systems.

5.3 Recommendations

Based on the conclusions drawn from this study, the following recommendations are made:

Farmers in Kabale and similar agroecological zones should be encouraged to adopt cover cropping practices, such as intercropping maize with legumes (e.g., beans), to improve land use efficiency and economic returns.

Further long-term studies should be conducted to evaluate the impacts of cover cropping on soil fertility, pest control, erosion prevention, and climate resilience, as well as overall sustainability across multiple cropping seasons.

Agricultural extension workers should conduct training programs on the benefits and implementation of cover cropping systems, focusing on planting density, pest management, and soil health practices.

Policymakers should develop and implement incentive structures—such as subsidies, seed access, or technical support programs—to promote sustainable practices like cover cropping, particularly in highland regions like Kabale.

To protect on-site agricultural experiments and demonstration plots, institutions like Bishop Barham University should implement security measures such as hiring security personnel, fencing plots, and controlling access, to deter theft and damage.

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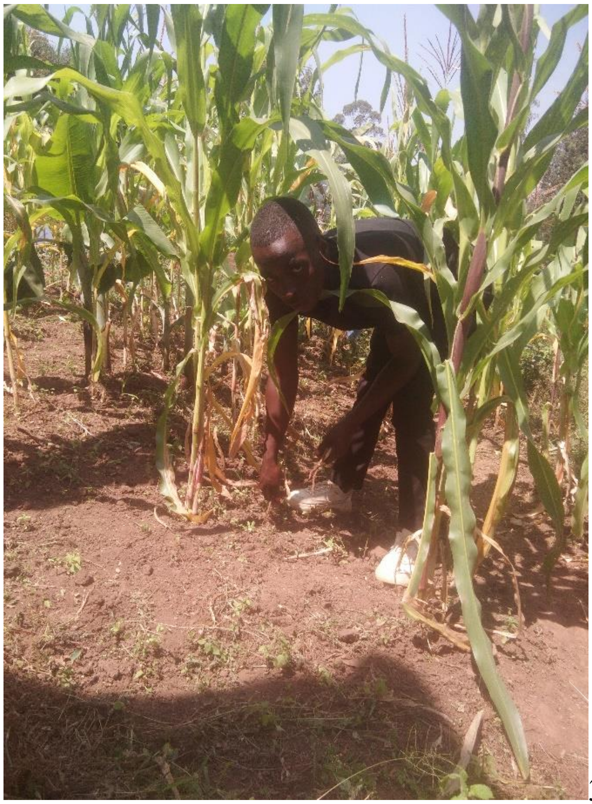
APPENDIX.

2. Measuring the plot size

2. weeding.



3.Taking measurements.