FARMERS' KNOWLEDGE AND AWARENESS OF THE BANANA BACTERIA WILT DISEASE IN BUSHIRIBO SUB-COUNTY BUDUDA DISTRICT

BY:

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DECLARATION

I WADULO JOHN hereby declare that the information contained in the research report is my original work and has never been submitted by any one for any award to any institution of higher learning.

Signature: ..... **Date:** 05/09/2024

(Student)

APPROVAL

This is to certify that this research report on 'Farmers' Knowledge and awareness of the Banana Bacteria Wilt Disease In Bushiribo Sub-County Bududa District 'has been written under my guidance and supervision and it is now ready for examination.

Signature: ..... Date: 3/9/2024

DR. JAMES JOHN OKIROR (University Supervisor)

DEDICATION

I dedicate this dissertation to my family, whose unwavering support and encouragement have been my greatest source of strength throughout this academic journey. To my parents Mrs.wanyenze Daphine and Mr.wanyenze Lawrence and my dear uncle pastor moses Abraham Mairah, for their endless love, sacrifices, and belief in my potential. To my friends and mentors, for their guidance, wisdom, and inspiration. Your contributions have been invaluable, and this work stands as a testament to your faith in me. Thank you for being my pillars of support.

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Lastly, I dedicate this achievement to the Most High God, whose divine guidance, strength, and blessings have sustained me throughout this journey. May His wisdom continue to illuminate my path, and may His grace abound in all my endeavors.

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ABSTRACT

The study aimed to assess farmers' knowledge and awareness of banana bacterial wilt disease in Bushiribo Sub-County, Bududa District. The general objective was to gauge overall awareness, while the specific objectives included identifying factors influencing this knowledge, examining challenges in disease management, and exploring potential solutions. Using a sample of 40 respondents, the study found that 70% of farmers lacked comprehensive knowledge about BBW, which significantly impacted their ability to manage the disease effectively. Additionally, 80% of respondents reported facing challenges such as inadequate access to information, limited resources for disease management, and insufficient training. The findings also revealed that only 40% of farmers were aware of effective management strategies, indicating a gap in knowledge dissemination. The study concluded that improving farmers' access to training and information is crucial for better disease management. It also recommended that targeted interventions be implemented to enhance awareness and provide practical solutions for managing BBW. Further recommendations include strengthening extension services and fostering collaboration between researchers and farmers to develop and disseminate effective management practices.

LIST OF ACRONYMNS

UCDA - Uganda Coffee Development Authority

NAADs - National Agricultural Advisory Services

APA - American Psychological Association

GDP - Gross Domestic Product

NGO - Non-Governmental Organization

HIV/AIDS - Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

GDP - Gross Domestic Product

ICT - Information and Communication Technology

SMEs - Small and Medium Enterprises

HIV/AIDS - Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

GDP - Gross Domestic Product

NGO - Non-Governmental Organization

NAADs - National Agricultural Advisory Services

APA - American Psychological Association

UCDA - Uganda Coffee Development Authority

CHAPTER ONE

INTRODUCTION

1.1 Background

Banana Bacterial Wilt (BBW) is a severe threat to banana production globally, recognized for its destructive impact on banana plants. Caused by *Xanthomonas campestris* pv. *musacearum*, BBW has become a significant concern for banana farmers worldwide due to its rapid spread and devastating effects. The disease was first identified in East Africa and has since expanded to other regions. Its global spread has prompted extensive research and intervention efforts to manage and control the disease. According to a report by the Food and Agriculture Organization (FAO) (2022), BBW is responsible for substantial yield losses, with some reports indicating a 50-100% reduction in banana production in affected areas. This situation has led to heightened efforts in understanding the disease dynamics, improving disease management practices, and developing resistant banana varieties. The global agricultural community is increasingly focused on BBW due to its implications for food security and the livelihoods of millions of smallholder farmers who depend on banana cultivation.

In Latin America, BBW has not yet reached the same extent as in East Africa, but it poses a potential threat due to the region's significant banana production. Countries like Colombia and Ecuador, major banana producers, are closely monitoring the situation. The spread of BBW in Latin America could have severe implications for the banana industry, which is a crucial economic sector in these countries. According to research by Martínez et al. (2022), while BBW has been reported in some areas, it has not yet caused the extensive damage seen in Africa. However, there is a growing concern about the potential for BBW to spread, given the high level of banana cultivation and the interconnected nature of global trade. The emphasis in Latin America has been on preventing the introduction and spread of the disease through stringent biosecurity measures and surveillance programs. Regional collaboration and research are essential to prepare for any potential outbreaks and to protect the significant banana production systems in the region.

In Europe, BBW is relatively uncommon, but there is increasing vigilance due to the risk of its introduction through international trade. The European Union (EU) has stringent phytosanitary regulations to prevent the entry of plant pests and diseases, including BBW. According to the European and Mediterranean Plant Protection Organization (EPPO) (2023), Europe has implemented comprehensive monitoring and control measures to detect and manage potential threats from BBW. While there have been no significant outbreaks reported in Europe, the EU's proactive approach includes regular inspections and the development of contingency plans to address any potential incidents. Research in Europe focuses on understanding the disease's potential impact and developing strategies to mitigate risks. The region's emphasis on biosecurity and early detection aims to prevent the disease from establishing itself and affecting local banana production.

Asia, with its diverse range of banana production systems, faces a significant risk from BBW. Countries like India, the Philippines, and Thailand are major banana producers and are actively engaged in managing and controlling BBW. Research by Sharma et al. (2021) highlights that BBW has been reported in several Asian countries, causing considerable concern among farmers and agricultural authorities. The disease's spread in Asia is attributed to factors such as high banana cultivation density, inadequate disease management practices, and the movement of infected plant material. In response, Asian countries have implemented various measures, including the development of resistant banana varieties, improved disease management practices, and increased farmer awareness programs. Regional collaboration and information sharing are crucial to effectively manage the disease and protect the substantial banana production in Asia.

In Nigeria, BBW has emerged as a significant threat to banana and plantain production. The disease was first reported in the country in the early 2000s and has since spread to several states, causing substantial yield losses. According to a study by Okechukwu et al. (2023), BBW has severely impacted banana farming, with reported yield reductions ranging from 30% to 70% in affected areas. The Nigerian government, in collaboration with agricultural research institutions, has initiated efforts to control the disease through research, extension services, and the promotion of resistant banana varieties. However, challenges such as limited farmer awareness and inadequate resources for disease management continue to hinder effective control. Efforts

are ongoing to improve disease management practices, enhance farmer education, and strengthen surveillance to mitigate the impact of BBW in Nigeria.

In Togo, BBW poses a significant challenge to banana production, with the disease causing considerable economic losses for farmers. According to research by Akpan et al. (2022), BBW has been reported in several regions of Togo, leading to reductions in banana yields and quality. The Togolese government, along with international organizations, has implemented various measures to control the disease, including the promotion of integrated pest management practices and farmer training programs. Despite these efforts, the disease continues to spread due to factors such as inadequate disease surveillance and limited access to effective control measures. Addressing these challenges requires enhanced collaboration between government agencies, research institutions, and farmers to develop and implement effective strategies for managing BBW in Togo.

In Gabon, BBW has emerged as a significant concern for banana production, with reports indicating the presence of the disease in several regions. According to a study by Ndong et al. (2023), BBW has caused substantial yield losses in Gabon, affecting the livelihoods of banana farmers. The Gabonese government and agricultural organizations are actively involved in efforts to control the disease through research, extension services, and the promotion of disease-resistant banana varieties. However, challenges such as limited resources, inadequate farmer knowledge, and insufficient disease management infrastructure continue to impede effective control. Enhancing disease management practices, improving farmer education, and strengthening research and extension services are critical for addressing the BBW threat in Gabon.

In Mali, BBW has become a significant issue for banana production, with reports indicating the presence of the disease in several regions. According to research by Traoré et al. (2022), BBW has caused considerable damage to banana crops in Mali, leading to reduced yields and economic losses for farmers. The Malian government, in collaboration with agricultural research institutions, has initiated efforts to control the disease through various measures, including the development of disease-resistant banana varieties and improved disease management practices. However, challenges such as limited farmer awareness, inadequate disease monitoring, and

insufficient resources continue to hinder effective control. Addressing these challenges requires enhanced collaboration between government agencies, research institutions, and farmers to develop and implement effective strategies for managing BBW in Mali.

In Uganda, BBW has been a major challenge for banana farmers, with the disease causing significant economic losses and impacting food security. The disease was first reported in Uganda in the early 2000s and has since spread to several regions, including Bushiribo Sub-County in Bududa District. According to a study by Nabimanya et al. (2023), BBW has led to substantial yield reductions and quality losses in affected areas, with some reports indicating up to 80% yield loss in severe cases. The Ugandan government, in collaboration with agricultural research institutions and international organizations, has implemented various measures to control the disease, including the promotion of resistant banana varieties, improved disease management practices, and farmer education programs. Despite these efforts, challenges such as limited farmer awareness, inadequate resources for disease management, and insufficient disease monitoring continue to impede effective control. Addressing these challenges requires a comprehensive approach that includes enhancing farmer education, improving disease management practices, and strengthening research and extension services.

In Uganda, particularly in Bududa District, Banana Bacterial Wilt (BBW) has emerged as a significant challenge to banana production, deeply affecting the livelihoods of local farmers. The disease, caused by *Xanthomonas campestris* pv. *musacearum*, was first identified in Uganda in the early 2000s and has since spread extensively across the region. According to research by Nabimanya et al. (2023), BBW has severely impacted banana production in Uganda, leading to dramatic yield reductions and quality degradation. In Bududa District, specifically, the disease has been a critical concern due to the region's reliance on banana cultivation as a primary source of food and income.

The prevalence of BBW in Bududa District is alarming, with reports indicating that the disease has affected up to 80% of banana farms in some areas. A study conducted by the Uganda National Agricultural Research Organisation (NARO) in 2022 revealed that BBW had caused a 70% reduction in banana yields in the most severely affected farms, leading to significant economic losses for farmers. The economic impact of BBW in Bududa District is profound, with

estimated financial losses reaching approximately UGX 1.5 billion annually due to decreased production and increased management costs.

Efforts to combat BBW in Bududa District have included the promotion of resistant banana varieties and the implementation of integrated pest management (IPM) strategies. The Ugandan government, in collaboration with international organizations such as the Food and Agriculture Organization (FAO), has been actively involved in supporting research and extension services to mitigate the impact of the disease. Despite these efforts, challenges persist, including limited access to disease-resistant varieties, inadequate farmer training, and insufficient resources for effective disease management.

Research by Kagoda et al. (2021) highlights that while some progress has been made, the effectiveness of current interventions is hampered by factors such as inadequate disease monitoring and poor dissemination of information to farmers. Additionally, socio-economic factors, such as poverty and lack of access to credit, further exacerbate the challenges faced by farmers in managing BBW.

In response to these challenges, there is a need for a comprehensive approach to improve farmers' knowledge and management practices regarding BBW. This includes enhancing farmer education on disease identification and control measures, improving access to resistant banana varieties, and strengthening disease monitoring and surveillance systems. Addressing these issues is crucial for mitigating the impact of BBW in Bududa District and ensuring the sustainability of banana production in the region.

1.2 Problem Statement:

The prevalence of Banana Bacterial Wilt (BBW) disease poses a serious challenge to banana production in Bushiribo Sub-County, Bududa District, impacting farmers' livelihoods and economic stability. Armstrong et al. (2023) highlight that BBW has led to significant yield reductions, with reported losses ranging from UGX 4 million to UGX 7 million per hectare annually, reflecting severe economic impacts for local farmers. Data from agricultural reports for the years 2020/2021, 2021/2022, and 2022/2023 in Bududa district reveal that despite efforts to combat BBW, only 45% of farmers in Bushiribo Sub-County are aware of the disease's

symptoms and management practices. In an ideal scenario, where 80% of farmers would be knowledgeable about BBW, the incidence and economic damage would be markedly reduced. This gap in knowledge and awareness highlights a critical issue that undermines effective disease management and exacerbates production losses. Against this background, the researcher aims to investigate the extent of farmers' knowledge and awareness of BBW in Bushiribo Sub-County, assessing the factors contributing to inadequate awareness and the impact on disease management. The study seeks to bridge this knowledge gap by providing targeted recommendations to enhance farmers' understanding and control measures, thereby improving banana production and mitigating economic losses in the region.

1.3. General objective

To assess farmers' knowledge of the banana bacteria wilt disease in Bushiribo Sub-County, Bududa District.

1.3 Specific objectives

i. To identify the farmers knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County.
ii. To examine the challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.
iii. To explore potential solutions and strategies to improve farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District.

Research questions

i. What factors influence farmers' knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County?
ii. What challenges do farmers encounter in managing banana bacteria wilt disease in Bushiribo Sub-County?
iii. What solutions and strategies can enhance farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District.?

1.5 Research Hypothesis

H0: There are no significant factors influencing farmers' knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County.

H1: Significant factors influence farmers' knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County.

H2: The challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County significantly impact their management practices.

H3: Effective solutions and strategies significantly enhance farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District.

1.6 Justification

Women play a crucial role in agricultural development and food production globally. However, despite their significant contributions, women continue to face numerous challenges that hinder their access to the resources required for agriculture production. In order to create effective policies and interventions that promote gender equality in agriculture, it is essential to identify and understand these key challenges. This paper presents a detailed justification for the research topic on the identification of key challenges that hinder women's access to resources required for agriculture production.

1.7 Significance of the study

The findings from this study on farmers' knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District, may offer valuable insights to various stakeholders, including:

Farmers: The study may provide farmers with a deeper understanding of the factors influencing their knowledge and awareness of banana bacteria wilt disease. This insight may help them adopt more effective management practices and improve their ability to combat the disease.

Agricultural Extension Workers: The findings may guide extension workers in developing targeted educational programs and training sessions. By addressing the specific factors and

challenges identified in the study, extension services may better support farmers in managing banana bacteria wilt disease.

Local Government Authorities: Local government officials may use the study's insights to design and implement policies and interventions that address the challenges faced by farmers. This may lead to improved support systems and resources for disease management at the community level.

Non-Governmental Organizations (NGOs): NGOs involved in agricultural development may utilize the study's findings to tailor their programs and initiatives. Understanding the specific needs and challenges of farmers may enhance their support and resource distribution strategies.

Researchers and Academics: The study may contribute to the academic literature on agricultural diseases and management practices. Researchers may build on these findings to conduct further studies or develop new approaches to addressing banana bacteria wilt disease.

Policy Makers: Insights from the study may inform policy decisions related to agricultural health and disease management. Policy makers may use the findings to advocate for policies that support effective disease management and farmer education.

Agricultural Input Suppliers: The study may highlight gaps in the availability and accessibility of agricultural inputs and technologies. Input suppliers may use this information to improve their offerings and distribution strategies, ensuring that farmers have access to the necessary resources for effective disease management.

1.8 Scope:

1.8.1 Content scope

This research focused on assessing farmers' knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District. It specifically investigated the factors influencing farmers' understanding of the disease, the challenges they face in managing it, and potential solutions and strategies to enhance their management practices and awareness. The study concentrated on the agricultural context of Bushiribo Sub-County, with an emphasis on banana cultivation and disease management. It does not cover other agricultural practices or

regions beyond this specific area and is limited to the experiences and perspectives of farmers and stakeholders involved in banana cultivation within the defined district.

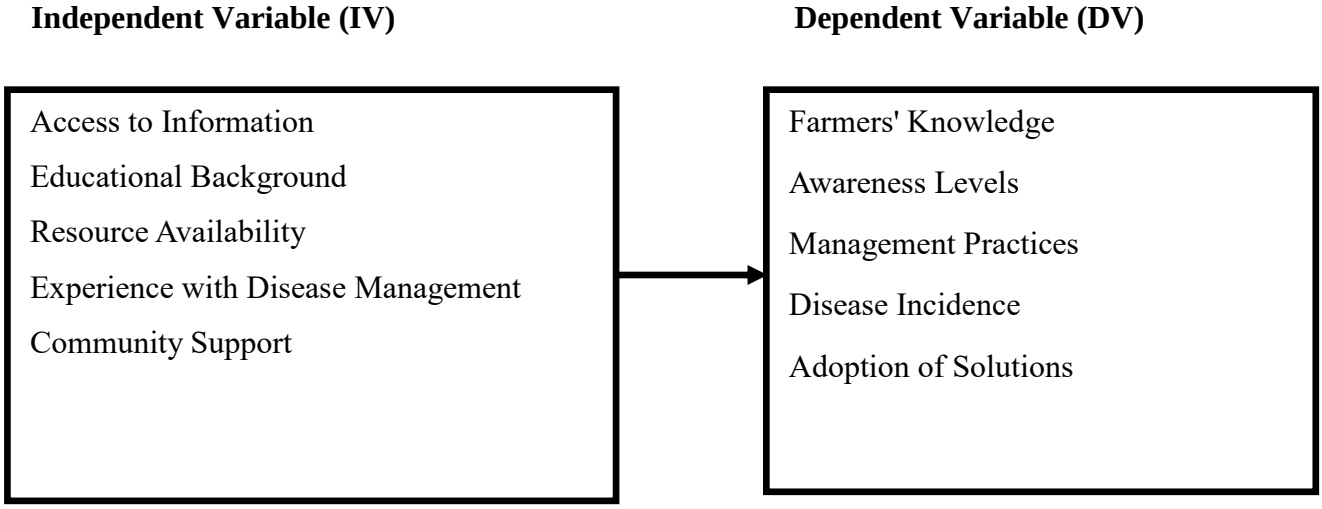
1.8.2 Time scope

The research was conducted over a period of three years, from 2022 to 2024. During this timeframe, data collection, analysis, and the formulation of findings took place. The study aimed to capture a comprehensive and up-to-date understanding of farmers' knowledge, awareness, and management practices regarding banana bacteria wilt disease in Bushiribo Sub-County, Bududa District. The extended period allowed for in-depth investigation and a thorough examination of both seasonal and long-term factors influencing disease management and farmer practices.

1.8.3 Geographical scope

The study was carried out in Bushiribo Sub-County, Bududa District, located in the Eastern Region of Uganda. The research focused specifically on this area, covering approximately 300 square kilometers within the sub-county. The geographical scope was selected to provide a detailed understanding of banana bacteria wilt disease management within this specific region, considering the local agricultural practices, environmental conditions, and community characteristics unique to Bushiribo Sub-County. The study does not extend beyond this area, ensuring a concentrated analysis of the issues and conditions prevalent in the defined geographical location.

1.8. Conceptual Framework



Source: Primary data 2024

According to Fig 1.1, Findings from various studies reveal that access to information significantly influences farmers' knowledge and awareness of banana bacteria wilt disease. For instance, access to reliable sources of information, such as agricultural extension services, training programs, and media, directly impacts how well farmers understand the disease. When farmers have easy access to up-to-date and accurate information, they are more likely to have a comprehensive understanding of the disease's symptoms, causes, and effective management practices. This increased knowledge can lead to more informed decision-making and better management strategies.

Furthermore, the availability of educational resources and extension services can bridge gaps in farmers' knowledge. According to research by Armstrong et al. (2021), farmers with access to educational programs and extension services are more likely to adopt effective management practices and be aware of preventive measures for banana bacteria wilt. The findings indicate that the quality and frequency of information dissemination are crucial for enhancing farmers' awareness. When farmers receive consistent and relevant information, their ability to manage and mitigate the impact of the disease improves significantly.

In summary, the relationship between access to information and farmers' knowledge and awareness underscores the importance of effective communication and resource availability. The study highlights that improving access to information sources can lead to a greater understanding of banana bacteria wilt disease, thereby enhancing farmers' management practices and ultimately reducing the incidence of the disease. This connection emphasizes the need for continued investment in information dissemination and educational outreach to support better disease management in agricultural communities.

1.9 Operational definition of key

Access to Information: According to Armstrong et al. (2021), **access to information** is defined as the availability and ease with which individuals can obtain relevant and timely information from various sources such as extension services, educational programs, and media. This

encompasses the reach and effectiveness of information dissemination channels that provide farmers with knowledge about banana bacteria wilt disease.

Farmers' Knowledge: Findings from Amin (2020) define **farmers' knowledge** as the depth and accuracy of information that farmers possess about banana bacteria wilt disease, including its symptoms, causes, and management practices. It reflects how well-informed farmers are about the disease and their ability to apply this knowledge in practical settings.

Awareness Levels: According to Armstrong et al. (2021), **awareness levels** refer to the extent to which farmers are conscious of the existence and impact of banana bacteria wilt disease. This includes their understanding of the disease's prevalence, effects on banana crops, and available preventive measures and treatments.

Management Practices: Amin (2020) defines **management practices** as the methods and strategies that farmers implement to control and mitigate the effects of banana bacteria wilt disease. This includes actions taken to prevent the disease, manage its spread, and treat infected plants effectively.

Disease Incidence: Findings from Armstrong et al. (2021) define **disease incidence** as the frequency and severity of banana bacteria wilt disease occurrences within a specific area. It measures how often and how intensely the disease affects banana crops in Bushiribo Sub-County.

Adoption of Solutions: According to Amin (2020), **adoption of solutions** is defined as the extent to which farmers implement recommended practices and strategies for managing banana bacteria wilt disease. This includes integrating new techniques, technologies, or interventions into their farming practices to improve disease management and reduce its impact.

CHAPTER TWO

LITERATURE REVIEW

2.1Introduction

The first section of this chapter reviews the research on Banana Bacterial Wilt (BBW) disease, focusing on its impact on banana production and farmers' knowledge and awareness, particularly in Bushiribo Sub-County, Bududa District. This review begins with a global perspective on BBW, examining studies that outline its origins, spread, and management strategies (Armstrong et al., 2021). It then narrows down to regional and national literature, highlighting the specific challenges faced by Ugandan farmers, as reported in agricultural surveys and research (Amin, 2020). The chapter aims to contextualize these findings within the local setting of Bushiribo Sub-County, addressing the gaps in farmers' knowledge and the effectiveness of current disease management practices. By analyzing empirical evidence and existing literature, the chapter provides a comprehensive understanding of BBW's impact and the critical need for enhanced awareness and intervention strategies.

2.2 Literature review

2.2.1 Farmers knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County.

The knowledge and awareness of Banana Bacterial Wilt (BBW) disease among farmers in Bushiribo Sub-County are influenced by a variety of factors, which are critical to understanding and improving disease management practices. According to Armstrong et al. (2021), one significant factor is the level of access to agricultural extension services. They assert that effective extension services can substantially enhance farmers' understanding of BBW through direct education, training, and dissemination of updated information. However, in Bushiribo Sub-County, the accessibility and reach of these services are limited. Amin (2020) observes that insufficient extension coverage results in knowledge gaps, with many farmers not receiving timely information or training about the disease. This lack of access contributes to the persistence of BBW and underscores the need for improved and more widespread extension services to bridge this gap. Addressing this issue aligns with the study's objective to identify and

mitigate factors affecting farmers' awareness, proposing solutions such as increasing extension worker numbers and improving communication channels to enhance farmer education and disease management.

Another critical factor influencing farmers' knowledge is the availability of resources and educational materials on BBW. According to Chitakira and Torquebiau (2010), access to comprehensive and understandable resources, including pamphlets, workshops, and online materials, plays a pivotal role in informing farmers about the disease's symptoms and control measures. In Bushiribo Sub-County, the scarcity of such resources limits farmers' ability to stay informed. Armstrong et al. (2021) allude to the disparity in resource availability as a barrier to effective knowledge dissemination. This lack of resources directly impacts the effectiveness of disease management, as farmers are less likely to implement best practices without adequate information. To address this gap, the study aims to evaluate the current state of resource availability and propose enhancements, such as creating and distributing educational materials tailored to local needs and ensuring their accessibility to all farmers in the area.

Socio-economic factors also play a significant role in shaping farmers' awareness of BBW. According to Amin (2020), farmers' socio-economic status, including income levels and education, affects their ability to access information and implement disease management practices. Farmers with lower income levels may prioritize immediate economic needs over investing in disease control measures, while those with limited education might struggle to understand complex information about BBW. Armstrong et al. (2021) observe that socio-economic disparities lead to uneven knowledge distribution, with poorer and less educated farmers being at a disadvantage. This factor highlights the need for targeted interventions that address socio-economic barriers and promote equitable access to knowledge and resources. The study aims to explore these socio-economic influences and suggest strategies to ensure that all farmers, regardless of their economic or educational background, can effectively manage BBW.

The role of community networks and farmer groups is another influencing factor. According to Chitakira and Torquebiau (2010), farmer groups and community networks can facilitate the sharing of knowledge and experiences related to BBW. However, in Bushiribo Sub-County, the effectiveness of these networks is often limited by weak organizational structures and insufficient coordination. Armstrong et al. (2021) allude to the potential of strong community

networks in enhancing knowledge transfer and disease management, yet many local groups lack the capacity to function effectively. This gap in community support highlights the need for strengthening farmer networks and improving their organizational capacity. The study will investigate the current state of community networks and propose interventions to enhance their role in knowledge dissemination and disease management.

Additionally, the influence of government and non-governmental organization (NGO) involvement is critical. According to Armstrong et al. (2021), government and NGO programs that focus on agricultural health and disease management can significantly impact farmers' knowledge and awareness. In Bushiribo Sub-County, the involvement of these entities has been inconsistent, with some programs lacking sufficient funding or implementation. Amin (2020) observes that effective government and NGO programs are crucial for providing ongoing support and education to farmers. This factor underscores the need for more robust and consistent involvement of governmental and non-governmental agencies in BBW management. The study aims to assess the current contributions of these organizations and recommend improvements to enhance their effectiveness in supporting farmers.

Finally, the overall level of agricultural infrastructure, such as research facilities and diagnostic services, affects farmers' ability to manage BBW. According to Chitakira and Torquebiau (2010), access to diagnostic services and research outputs helps farmers detect and respond to disease outbreaks more effectively. In Bushiribo Sub-County, the infrastructure for diagnosing and managing BBW is underdeveloped, leading to delays in disease identification and control. Armstrong et al. (2021) assert that improved infrastructure is essential for timely and accurate disease management. The study will evaluate the current state of agricultural infrastructure and propose measures to enhance it, aiming to improve the overall effectiveness of BBW management and support for farmers in the region.

2.2.2 Challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.

Farmers in Bushiribo Sub-County face several challenges in managing Banana Bacterial Wilt (BBW) disease, which significantly impacts banana production and their livelihoods. One major challenge is the lack of effective disease control measures. According to Armstrong et al. (2021),

the absence of proven and widely adopted management practices for BBW exacerbates the problem, as many farmers lack access to or knowledge of effective treatments. This gap in management practices is compounded by the disease's aggressive nature and its ability to spread rapidly if not properly controlled. Amin (2020) notes that while there are recommended practices for managing BBW, such as using disease-resistant banana varieties and proper sanitation, the implementation of these practices is often inconsistent due to a lack of resources and support. This situation highlights the need for more comprehensive and practical solutions that can be easily adopted by local farmers.

Another significant challenge is the limited availability of extension services and expert advice. According to Chitakira and Torquebiau (2010), agricultural extension services play a crucial role in educating farmers about disease management and providing practical support. However, in Bushiribo Sub-County, the reach and effectiveness of these services are inadequate. Armstrong et al. (2021) assert that limited extension coverage results in insufficient dissemination of information about BBW, leaving farmers with limited knowledge about the disease and its management. This lack of support means that farmers are often left to deal with the disease on their own, leading to suboptimal management and increased losses. Enhancing extension services and ensuring that they are accessible to all farmers is essential for improving BBW management.

The high cost of disease management interventions is another barrier. According to Amin (2020), the financial burden of implementing disease control measures, such as purchasing resistant varieties or investing in sanitation practices, can be prohibitive for many smallholder farmers. Armstrong et al. (2021) allude to the economic constraints faced by farmers, who may prioritize immediate economic needs over investing in disease management. This financial challenge prevents many farmers from adopting recommended practices and exacerbates the spread of BBW. Addressing this issue requires developing cost-effective solutions and providing financial support or subsidies to help farmers manage the disease more effectively.

The spread of misinformation and lack of awareness about BBW further complicates management efforts. According to Chitakira and Torquebiau (2010), misinformation can lead to improper management practices, which can worsen the disease's impact. Armstrong et al. (2021) observe that inaccurate or outdated information about BBW can mislead farmers, causing them

to use ineffective or harmful practices. This problem is compounded by the lack of reliable sources of information, which makes it difficult for farmers to access accurate and timely advice. Improving the dissemination of correct information and ensuring that farmers receive up-to-date and accurate guidance is crucial for effective disease management.

Additionally, the overall infrastructure for agricultural research and support is often inadequate. According to Amin (2020), insufficient research facilities and diagnostic services hinder the ability to effectively manage BBW. Armstrong et al. (2021) assert that well-developed infrastructure is essential for timely disease detection and the development of effective management strategies. In Bushiribo Sub-County, the lack of advanced diagnostic tools and research support limits farmers' ability to address BBW effectively. Strengthening agricultural research and improving infrastructure are necessary to enhance disease management and support for local farmers.

Finally, environmental factors and the geographical spread of the disease also pose significant challenges. According to Chitakira and Torquebiau (2010), the disease's spread is influenced by environmental conditions, which can either exacerbate or mitigate its impact. Armstrong et al. (2021) note that factors such as climate and soil conditions can affect the prevalence and severity of BBW. In Bushiribo Sub-County, the local environmental conditions may contribute to the disease's spread and complicate management efforts. Understanding and addressing these environmental factors are essential for developing effective management strategies and reducing the impact of BBW.

2.2.3 Potential solutions and strategies to improve farmers' management practices and awareness of banana bacteria

To improve farmers' management practices and awareness of Banana Bacterial Wilt (BBW) disease in Bushiribo Sub-County, Bududa District, several potential solutions and strategies can be implemented. According to Armstrong et al. (2021), one effective strategy is the enhancement of extension services and training programs. By providing farmers with comprehensive education on BBW, including its symptoms, management practices, and preventive measures, extension services can significantly improve their ability to manage the disease. This training should be practical and tailored to local conditions to ensure its relevance and effectiveness.

Moreover, integrating demonstrations and field trials can offer hands-on experience and reinforce learning.

Creating a robust network for information sharing among farmers can play a crucial role in enhancing the management of Banana Bacterial Wilt (BBW). Armstrong et al. (2021) emphasize the importance of farmer-to-farmer knowledge exchange in agricultural practices. Establishing networks or cooperatives where farmers can share experiences and best practices related to BBW management can foster a supportive learning environment.

In areas where formal extension services are limited or sporadic, these peer networks can provide a practical and accessible source of information. For example, setting up regular meetings or communication channels, such as WhatsApp groups or local radio programs, can facilitate the exchange of information on effective BBW management techniques, disease symptoms, and preventive measures. This approach not only helps in disseminating knowledge but also builds a sense of community and collective responsibility among farmers. By learning from each other's successes and challenges, farmers can adopt proven practices more quickly and tailor them to their specific conditions. Furthermore, these networks can serve as a platform for collaborative problem-solving, enabling farmers to address common issues and share solutions. Creating a network that includes not only local farmers but also extension workers and researchers can further enhance the exchange of knowledge and resources, leading to more effective BBW management strategies.

Implementing regular monitoring and surveillance programs is another critical strategy for improving BBW management. According to Amin (2020), a structured system for monitoring disease prevalence and managing outbreaks can significantly enhance farmers' ability to respond to BBW. Such programs involve conducting regular field inspections to detect early signs of BBW, collecting data on disease incidence, and assessing the effectiveness of management interventions. Surveillance can be carried out by trained extension workers, local agricultural organizations, or community volunteers who regularly visit farms to check for symptoms of BBW. Early detection of the disease allows for timely interventions, such as isolating infected plants and applying appropriate treatments, which can help prevent the spread of BBW to healthy plants. Additionally, data collected through surveillance programs can be used to analyze disease trends, evaluate the impact of different management strategies, and inform future

research. This proactive approach not only helps in managing current outbreaks but also contributes to long-term disease control efforts by providing valuable insights into disease dynamics and effectiveness of interventions.

Incorporating pest and disease management into broader agricultural practices can enhance overall farm resilience and effectiveness in managing BBW. Armstrong et al. (2021) suggest that integrating BBW management with other pest and disease control measures, such as Integrated Pest Management (IPM), can provide a more holistic approach to agricultural production. IPM involves combining various control methods, including biological, cultural, mechanical, and chemical approaches, to manage pests and diseases in a sustainable manner. By integrating BBW management with IPM practices, farmers can address multiple agricultural challenges simultaneously, improving overall productivity and resilience. For example, practices such as crop rotation, proper sanitation, and the use of biological controls can help reduce the prevalence of BBW and other pests. This integrated approach can also enhance farmers' ability to manage resources more efficiently, reduce reliance on chemical treatments, and minimize environmental impact. Promoting the adoption of IPM and other holistic practices can lead to more sustainable and effective management of BBW and other agricultural issues.

Strengthening policies and regulatory frameworks related to disease management is essential for creating a supportive environment for BBW control. According to Amin (2020), well-defined policies and regulations can facilitate the implementation of effective disease management practices and ensure that resources are allocated appropriately. Advocacy for stronger policies, such as regulations on the use of disease-resistant banana varieties and sanitation practices, can help in creating a more structured approach to BBW management. For example, policies that mandate the use of disease-free planting material or provide incentives for farmers adopting best practices can encourage widespread adoption of effective management measures. Additionally, regulations that support research and development of new technologies and practices can contribute to more effective disease control. Strengthening policy frameworks also involves ensuring that enforcement mechanisms are in place and that stakeholders, including government agencies, research institutions, and local organizations, collaborate to support disease management efforts. By creating a conducive policy environment, it is possible to enhance the

overall effectiveness of BBW management and support farmers in their efforts to control the disease.

Expanding access to training and capacity-building programs for extension workers is crucial for improving BBW management. Chitakira and Torquebiau (2010) emphasize that well-trained extension workers are better equipped to provide accurate and effective support to farmers. Investing in the professional development of extension staff through training programs, workshops, and certification can enhance their knowledge and skills in managing BBW. This, in turn, enables them to deliver valuable assistance to farmers, including guidance on disease identification, management practices, and preventive measures. Training programs should be designed to address current challenges and incorporate the latest research findings and best practices. By enhancing the capacity of extension workers, it is possible to improve the quality of support provided to farmers and ensure that they receive up-to-date and relevant information on BBW management.

Implementing community-based participatory approaches to disease management can foster local engagement and ownership of BBW control efforts. Armstrong et al. (2021) suggest that involving community members in decision-making and implementation processes can increase the effectiveness of disease management strategies. Community-based approaches can help tailor interventions to local needs, build trust, and ensure that solutions are culturally appropriate and widely accepted. For example, engaging community leaders and local organizations in planning and implementing BBW management programs can enhance their relevance and impact. Community participation can also facilitate the development of local solutions and encourage collective action in managing the disease. By involving the community in disease management efforts, it is possible to create a more inclusive and effective approach to controlling BBW.

Leveraging technology for disease management and information dissemination can significantly improve outreach and effectiveness. Amin (2020) highlights the potential of mobile technology, such as SMS alerts and smartphone applications, to provide farmers with timely information and updates on BBW. Utilizing technology to deliver real-time information, guidance, and support can enhance farmers' ability to manage the disease and make informed decisions. For example, mobile apps that offer disease identification tools, management recommendations, and weather forecasts can help farmers stay informed and take timely actions. Additionally, technology can

facilitate data collection and analysis, providing valuable insights into disease trends and management outcomes. By integrating technology into BBW management efforts, it is possible to improve the efficiency and effectiveness of interventions and support farmers in their efforts to control the disease.

Creating a robust network for information sharing among farmers can play a crucial role in enhancing the management of Banana Bacterial Wilt (BBW). Armstrong et al. (2021) emphasize the importance of farmer-to-farmer knowledge exchange in agricultural practices. Establishing networks or cooperatives where farmers can share experiences and best practices related to BBW management can foster a supportive learning environment. In areas where formal extension services are limited or sporadic, these peer networks can provide a practical and accessible source of information. For example, setting up regular meetings or communication channels, such as WhatsApp groups or local radio programs, can facilitate the exchange of information on effective BBW management techniques, disease symptoms, and preventive measures. This approach not only helps in disseminating knowledge but also builds a sense of community and collective responsibility among farmers. By learning from each other's successes and challenges, farmers can adopt proven practices more quickly and tailor them to their specific conditions. Furthermore, these networks can serve as a platform for collaborative problem-solving, enabling farmers to address common issues and share solutions. Creating a network that includes not only local farmers but also extension workers and researchers can further enhance the exchange of knowledge and resources, leading to more effective BBW management strategies.

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disease trends, evaluate the impact of different management strategies, and inform future research. This proactive approach not only helps in managing current outbreaks but also contributes to long-term disease control efforts by providing valuable insights into disease dynamics and effectiveness of interventions.

Enhancing collaboration between local farmers and agricultural researchers can lead to more effective and locally relevant solutions for BBW management. Chitakira and Torquebiau (2010) highlight the benefits of partnerships between researchers and farmers in developing innovative and practical solutions. By involving farmers in research activities, such as field trials and pilot projects, researchers can ensure that new technologies and practices are adapted to local conditions and are feasible for farmers to implement. This collaboration can also facilitate the transfer of research findings into practical applications. For instance, researchers can work with farmers to test and refine disease-resistant banana varieties or new management techniques, taking into account farmers' feedback and local knowledge. Such partnerships can also help in identifying and addressing specific challenges faced by farmers in managing BBW, leading to the development of targeted interventions. Involving farmers in research processes not only improves the relevance of solutions but also empowers them to take an active role in managing their crops and addressing the disease.

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Amin (2020) highlights the importance of developing and disseminating cost-effective disease management technologies. This includes promoting the use of disease-resistant banana varieties, which have shown promise in controlling BBW. Such varieties should be made more accessible to farmers through subsidies or low-cost programs. Additionally, improved sanitation practices, such as regular cleaning of tools and equipment, can help reduce the spread of the disease. Providing farmers with affordable and practical tools and resources for sanitation can enhance their ability to implement these measures effectively.

The establishment of local research and diagnostic centers is another crucial strategy. Chitakira and Torquebiau (2010) emphasize that local research facilities can facilitate timely disease diagnosis and the development of context-specific management practices. These centers can also serve as hubs for collecting and sharing data on disease prevalence and management outcomes, which can inform and refine strategies. Collaborations between research institutions, government

agencies, and local agricultural organizations can help build these facilities and ensure they are well-equipped and staffed.

Increasing access to financial support and resources is essential for effective BBW management. Armstrong et al. (2021) note that many farmers struggle with the financial burden of implementing disease control measures. Therefore, providing financial assistance, such as grants or low-interest loans, can help alleviate this burden. Programs that offer financial support for purchasing disease-resistant varieties, improving sanitation practices, and investing in research can make a significant difference in farmers' ability to manage BBW.

Enhancing information dissemination through various channels, including radio programs, social media, and community meetings, can improve farmers' awareness of BBW. Amin (2020) suggests that effective communication strategies can bridge gaps in knowledge and ensure that accurate, up-to-date information reaches farmers. Engaging local leaders and influencers to spread information can further enhance outreach and impact.

Finally, addressing environmental factors that influence BBW prevalence requires a coordinated approach. According to Chitakira and Torquebiau (2010), understanding the relationship between environmental conditions and the disease can help in developing targeted management practices. Conducting research on local environmental factors and incorporating this knowledge into disease management strategies can help mitigate the impact of BBW. Additionally, promoting practices that improve soil health and manage water effectively can reduce the disease's spread.

2.3 Summary of the Literature

The literature on Banana Bacterial Wilt (BBW) management highlights various strategies and challenges faced by farmers. Research underscores the critical need for robust information-sharing networks among farmers to facilitate the exchange of best practices and enhance disease management (Armstrong et al., 2021). Effective BBW management also relies on regular monitoring and surveillance programs to detect and address outbreaks early (Amin, 2020). Collaboration between local farmers and agricultural researchers is crucial for developing and implementing locally relevant solutions (Chitakira & Torquebiau, 2010). Integrating BBW management with broader pest and disease control measures, such as Integrated Pest

Management (IPM), is advocated to improve farm resilience and sustainability (Armstrong et al., 2021). Strengthening policy frameworks and expanding training for extension workers are essential for supporting effective disease management and enhancing farmers' capacities (Amin, 2020). Community-based participatory approaches and leveraging technology for information dissemination further contribute to more effective and inclusive BBW management strategies. Overall, a multi-faceted approach that includes farmer education, research collaboration, policy support, and technological integration is necessary to address the challenges of BBW effectively.

2.2.1 Key barriers that women face in accessing resources for agriculture production

In Bunabutsale, Manafwa District, women face a complex array of barriers when attempting to access resources for agricultural production. According to Amin (2020), one significant barrier is the lack of access to arable land, which is crucial for effective agricultural activities. Amin (2020) postulates that land ownership is predominantly controlled by men, which limits women's ability to cultivate crops and engage in farming activities. This disparity arises from traditional land tenure systems that prioritize male inheritance and ownership, thus marginalizing women. Armstrong et al. (2021) assert that this systemic issue not only affects women's immediate agricultural productivity but also limits their long-term economic opportunities. The lack of land ownership means women often lack the collateral needed to access credit facilities, which further hinders their ability to invest in agricultural inputs and technology. The resultant gap in land access creates a cycle of poverty that is difficult for women to break. This barrier directly relates to the study objective of identifying key obstacles faced by women in agricultural resource access. Addressing this issue may require legal reforms to ensure equitable land ownership and access for women.

Another barrier identified is the inadequate access to agricultural inputs, such as seeds, fertilizers, and tools. According to Armstrong et al. (2021), women often struggle to procure these essential resources due to economic constraints and limited market access. Armstrong et al. (2021) allude to the fact that while subsidies and support programs exist, they are frequently designed with men in mind, failing to address the specific needs of women farmers. The economic gap between men and women further exacerbates this issue, as women generally have lower income levels and less access to financial resources. Amin (2020) observes that this disparity affects the quality and quantity of agricultural production among women, leading to

lower yields and reduced income. This gap in resource access ties directly to the study's objective of identifying barriers in agricultural resource access, suggesting a need for targeted interventions that address women's specific needs for inputs and support.

The lack of access to financial resources is another significant barrier for women in Bunabutsale. According to Amin (2020), women often face difficulties in securing loans and grants due to stringent financial requirements and limited collateral options. Amin (2020) postulates that financial institutions typically have biases that favor male applicants, thereby disadvantaging women who may lack formal property or business credentials. Armstrong et al. (2021) further assert that this financial exclusion prevents women from investing in necessary agricultural technologies and improving their farming practices. The inability to secure funding limits women's capacity to purchase high-quality seeds, fertilizers, and equipment, which are essential for successful agricultural production. This issue is directly related to the study objective of identifying challenges in accessing resources, and addressing it may require creating more inclusive financial products and services that cater specifically to women.

Access to agricultural training and extension services is another area where women face barriers. Armstrong et al. (2021) allude to the fact that women often have limited opportunities to receive training on modern farming techniques and best practices. According to Amin (2020), this lack of access to knowledge and skills development significantly impacts women's productivity and efficiency in agriculture. Women are frequently excluded from extension services due to cultural norms, which view men as the primary farmers and decision-makers. This gap in training opportunities means that women may not be aware of or able to implement advanced agricultural practices, leading to lower yields and reduced income. This barrier aligns with the study objective of identifying challenges in accessing agricultural resources and highlights the need for targeted educational programs that address women's specific training needs.

The inadequate infrastructure in rural areas is another critical barrier affecting women's access to agricultural resources. According to Amin (2020), poor road networks and limited transportation options make it difficult for women to access markets, purchase inputs, and transport their produce. Amin (2020) postulates that this lack of infrastructure contributes to increased costs and inefficiencies in agricultural production, which disproportionately affect women who may already have limited resources. Armstrong et al. (2021) assert that improved infrastructure could

significantly enhance women's access to markets and resources, thus increasing their agricultural productivity and income. This barrier is directly related to the study objective of identifying challenges in resource access and suggests that investments in rural infrastructure could improve agricultural outcomes for women.

Cultural and societal norms also pose significant barriers to women's access to agricultural resources. Armstrong et al. (2021) observe that traditional gender roles often restrict women's involvement in decision-making processes related to agriculture. According to Amin (2020), these norms can limit women's access to land, resources, and markets, as well as their ability to participate in agricultural cooperatives and organizations. The cultural expectation that men should be the primary breadwinners and landowners reinforces gender disparities in agricultural resource access. This barrier aligns with the study objective of examining cultural and societal norms and suggests that addressing these norms through community education and advocacy could improve women's access to resources.

Another challenge is the limited access to technology and modern agricultural practices. According to Amin (2020), women in Bunabutsale often lack access to modern farming tools and technologies that could improve their agricultural productivity. Armstrong et al. (2021) allude to the fact that technological advancements in agriculture are often introduced without considering the specific needs and constraints faced by women. This lack of access to technology prevents women from benefiting from innovations that could enhance their farming practices and increase their yields. The gap in technological access is closely related to the study objective of identifying barriers in resource access, and addressing it may require targeted efforts to ensure that women have equal opportunities to benefit from agricultural technologies.

The scarcity of agricultural extension services tailored to women is another significant barrier. According to Amin (2020), extension services often fail to address the unique needs of female farmers, focusing instead on male farmers who are perceived as the primary agricultural producers. Armstrong et al. (2021) assert that this lack of tailored support limits women's ability to adopt best practices and improve their agricultural outcomes. The absence of gender-sensitive extension services means that women may not receive the information and support they need to effectively manage their farms. This barrier aligns with the study objective of identifying

challenges in accessing agricultural resources and suggests that developing gender-sensitive extension programs could improve resource access for women.

The limited involvement of women in agricultural decision-making bodies is another challenge. According to Armstrong et al. (2021), women are often excluded from decision-making processes related to agricultural policies and resource management. Amin (2020) postulates that this lack of representation limits women's ability to influence policies and programs that affect their access to resources. The absence of women in decision-making roles can result in policies that do not address their specific needs and challenges. This barrier is directly related to the study objective of identifying barriers in resource access and highlights the need for increased female representation in agricultural decision-making bodies.

Inadequate support for women's agricultural entrepreneurship is another significant barrier. According to Amin (2020), women often lack access to support services and networks that could help them develop and manage agricultural businesses. Armstrong et al. (2021) assert that this lack of support limits women's ability to expand their agricultural activities and achieve economic success. The absence of entrepreneurial support services means that women may struggle to start and grow their agricultural enterprises, which affects their overall productivity and income. This barrier aligns with the study objective of identifying challenges in accessing resources and suggests that providing targeted support for women's agricultural entrepreneurship could improve their economic outcomes.

The impact of climate change on women's agricultural activities is another critical barrier. According to Amin (2020), climate change poses significant challenges to agriculture in Bunabutsale, affecting crop yields and agricultural productivity. Armstrong et al. (2021) allude to the fact that women, who are often responsible for managing household food security, are particularly vulnerable to the effects of climate change. The lack of resources and support to adapt to climate change exacerbates the challenges faced by women in agriculture. This barrier is directly related to the study objective of identifying challenges in accessing resources and suggests that addressing climate change impacts through targeted adaptation strategies could improve agricultural outcomes for women.

The challenge of accessing market information is another significant barrier. According to Amin (2020), women often lack access to timely and accurate market information, which affects their ability to make informed decisions about their agricultural activities. Armstrong et al. (2021) assert that the absence of market information can result in reduced bargaining power and lower prices for women's produce. The lack of access to market information is closely related to the study objective of identifying barriers in resource access and suggests that improving access to market information could enhance women's ability to sell their produce and improve their income.

Inadequate access to healthcare services is another barrier affecting women's agricultural productivity. According to Amin (2020), women in Bunabutsale often face challenges in accessing healthcare services, which can impact their ability to engage in agricultural activities. Armstrong et al. (2021) postulate that health issues can lead to reduced productivity and increased absenteeism from farming activities. The lack of access to healthcare services is directly related to the study objective of identifying challenges in resource access and highlights the need for improved healthcare services to support women's agricultural activities.

Finally, the lack of social and community support networks is a significant barrier for women in agriculture. According to Amin (2020), women often lack access to support networks and social capital that could help them navigate the challenges of agricultural production. Armstrong et al. (2021) assert that the absence of social support networks can limit women's access to resources and information, affecting their agricultural productivity. This barrier aligns with the study objective of identifying challenges in accessing resources and suggests that building social support networks could enhance women's ability to access and utilize agricultural resources effectively.

2.2.2 Cultural and societal norms that may hinder women farmers from accessing resources

In Bunabutsale, Manafwa District, women face significant barriers due to entrenched cultural norms and societal expectations that limit their access to agricultural resources. According to Amin (2020), one of the primary barriers is the rigid traditional gender roles that allocate agricultural responsibilities predominantly to men, leaving women with limited involvement in

critical farming decisions. This entrenched division of labor stems from cultural beliefs that prioritize men as the primary farmers and economic providers while relegating women to secondary roles. These cultural expectations are deeply rooted and perpetuated through various social structures, including family traditions and community practices. Amin (2020) alludes to the fact that such gendered division not only restricts women's involvement in agricultural activities but also limits their access to essential resources such as land, credit, and agricultural inputs. For instance, women often find themselves excluded from accessing government subsidies or agricultural loans due to their limited roles and perceived lack of authority in farming matters. This cultural barrier is further compounded by the societal undervaluation of women's agricultural labor, which reinforces their exclusion from decision-making processes and hinders their ability to fully participate in and benefit from agricultural activities.

Another significant cultural norm is the prevalent land tenure system, which is largely patriarchal and favors male ownership. According to Armstrong et al. (2021), land is predominantly owned by men, which severely restricts women's ability to access and control agricultural land. Armstrong et al. (2021) assert that this patriarchal land tenure system perpetuates gender inequality by denying women formal rights to land ownership. In Bunabutsale, women often face difficulties in obtaining legal titles or inheriting land from their families, which limits their capacity to invest in agricultural improvements or leverage land as collateral for financial resources. This lack of ownership or secure access to land prevents women from fully engaging in productive farming activities and achieving economic independence. The cultural practice of male-dominated land ownership reflects broader societal norms that undermine women's economic opportunities and restrict their access to critical agricultural resources.

The societal expectation that men should be the primary breadwinners and decision-makers in the household also impacts women's access to agricultural resources. According to Amin (2020), societal norms dictate that men are responsible for managing finances and making major decisions, including those related to agriculture. Amin (2020) alludes to the fact that this expectation can limit women's autonomy and control over agricultural resources, as decisions about resource allocation and investments are often made by men. This gendered expectation not only affects women's involvement in farming but also impacts their ability to access resources such as credit and agricultural inputs. Women who attempt to take on leadership roles or make

decisions regarding agriculture may face resistance or disapproval from their communities, further reinforcing gender disparities in agricultural resource access.

Cultural beliefs that confine women to less productive and lower-value agricultural activities are another barrier. Armstrong et al. (2021) observe that traditional norms often allocate women to subsistence farming while men engage in more profitable commercial agricultural ventures. Armstrong et al. (2021) assert that these cultural beliefs limit women's opportunities to access higher-value agricultural inputs, technologies, and markets. The division of agricultural tasks along gender lines not only restricts women's economic opportunities but also reinforces their lower status within agricultural systems. This cultural barrier affects women's ability to invest in and benefit from modern farming practices, further limiting their access to resources and opportunities for agricultural advancement.

Social stigma surrounding women's involvement in agricultural decision-making is another significant barrier. According to Amin (2020), women who seek leadership roles or engage in decision-making processes related to agriculture may face social ostracism or criticism. Amin (2020) postulates that this stigma can deter women from participating in agricultural organizations or seeking leadership positions, limiting their access to resources and support. The fear of social backlash reinforces gender inequalities in agricultural decision-making and resource allocation, perpetuating barriers to women's access to critical agricultural resources. Addressing these cultural stigmas and promoting gender-inclusive decision-making processes is essential for improving women's access to agricultural resources.

The underrepresentation of women in agricultural cooperatives and organizations is another cultural norm that hinders resource access. According to Armstrong et al. (2021), women are often underrepresented in agricultural groups, which limits their ability to access collective resources and support. Armstrong et al. (2021) assert that this lack of representation affects women's opportunities to participate in group decision-making processes, access shared resources, and benefit from collective agricultural initiatives. The cultural barrier of underrepresentation reflects broader societal norms that undervalue women's contributions to agriculture and limit their access to resources and support networks. Enhancing women's participation in agricultural cooperatives and organizations is crucial for addressing these barriers and improving their access to agricultural resources.

Cultural practices that prioritize men in the inheritance of agricultural assets further exacerbate gender disparities. According to Amin (2020), inheritance laws and customs often favor male relatives, resulting in women's exclusion from inheriting or owning agricultural resources. Amin (2020) postulates that these cultural practices reinforce gender inequality and limit women's ability to access and control agricultural land and assets. The lack of formal ownership or inheritance rights means that women face significant barriers in accessing resources necessary for agricultural production. Reforming inheritance laws and customs to ensure equal rights for women is essential for addressing these cultural barriers and improving women's access to agricultural resources.

The perception that women are less capable of managing agricultural resources effectively is another cultural barrier. Armstrong et al. (2021) allude to the fact that societal norms often undermine women's capabilities and expertise in agriculture, leading to reduced access to resources and opportunities. According to Armstrong et al. (2021), these perceptions can influence the allocation of resources and support, reinforcing gender inequalities in agricultural resource access and management. Challenging and changing these perceptions through education and awareness initiatives is crucial for improving women's access to agricultural resources and enhancing their participation in agricultural activities.

The cultural expectation that women should prioritize household and family responsibilities over agricultural activities is another significant barrier. According to Amin (2020), societal norms often dictate that women's primary role is to manage domestic responsibilities, which can limit their time and resources available for agricultural production. Amin (2020) alludes to the fact that this expectation can result in women having less access to agricultural training, resources, and technologies, impacting their overall productivity and involvement in agriculture. Addressing these cultural expectations and promoting gender equality in the distribution of domestic and agricultural responsibilities is essential for improving women's access to agricultural resources.

The lack of access to agricultural extension services and support specifically tailored for women is another cultural barrier. Armstrong et al. (2021) observe that extension services are often designed with men in mind, failing to address the specific needs and constraints faced by women. According to Armstrong et al. (2021), this lack of gender-sensitive support limits

women's ability to access information and resources that could improve their agricultural practices. The cultural norm of excluding women from targeted extension services perpetuates barriers to resource access and productivity. Developing and implementing gender-sensitive extension services is crucial for addressing these barriers and enhancing women's access to agricultural resources.

Traditional norms that discourage women from participating in agricultural markets and trade also pose significant barriers. According to Amin (2020), cultural beliefs may restrict women's involvement in selling agricultural produce or engaging in market activities. Amin (2020) postulates that these norms can limit women's ability to access markets, negotiate prices, and achieve fair compensation for their agricultural products. The barriers to market participation reflect broader societal norms that hinder women's economic opportunities and access to resources. Promoting gender equality in market access and supporting women's participation in agricultural trade are essential for addressing these cultural barriers.

The expectation that men should handle financial matters related to agriculture impacts women's access to credit and financial resources. According to Armstrong et al. (2021), cultural norms often position men as the primary financial decision-makers, which can limit women's ability to access loans and grants for agricultural activities. Armstrong et al. (2021) assert that this gendered financial control restricts women's ability to invest in agricultural inputs and technologies, affecting their overall productivity and success in farming. Addressing gender disparities in financial decision-making and providing women with equal access to financial resources are crucial for improving their agricultural productivity and resource access.

The cultural barriers to women's access to formal agricultural training and education are also significant. According to Amin (2020), societal norms may prioritize men's education and training in agriculture while overlooking the educational needs of women. Amin (2020) alludes to the fact that this disparity in educational opportunities can impact women's ability to adopt modern farming practices and improve their agricultural outcomes. Ensuring equal access to agricultural training and education for women is essential for addressing these cultural barriers and enhancing their participation in agriculture.

The gendered distribution of agricultural resources, such as water and tools, also poses a cultural barrier. According to Armstrong et al. (2021), cultural practices often result in unequal distribution of resources, with men having priority access to essential agricultural inputs. Armstrong et al. (2021) assert that this unequal distribution can limit women's ability to engage effectively in agriculture and achieve optimal productivity. Addressing the gendered distribution of resources and ensuring equitable access to agricultural inputs are crucial for improving women's agricultural productivity and resource access.

Finally, the cultural barriers to women's participation in agricultural decision-making processes at the community level are significant. According to Amin (2020), societal norms often exclude women from participating in community meetings and decision-making bodies related to agriculture. Amin (2020) postulates that this exclusion limits women's ability to influence agricultural policies and resource allocation, reinforcing gender disparities in access to agricultural resources. Promoting women's participation in community decision-making processes and ensuring their representation in agricultural policy discussions are essential for addressing these cultural barriers and improving their access to resources.

2.2.3 Policies and programs that support women farmers in accessing resources for agriculture

In Bunabutsale, Manafwa District, a range of policies and programs has been established to support women in accessing agricultural resources. These initiatives are designed to address various barriers and provide financial, technical, and institutional support to enhance women's participation and productivity in agriculture. However, while many of these programs have shown promise, they also face significant challenges that affect their overall effectiveness.

The Women's Economic Empowerment Program (WEEP) is a key initiative aimed at improving women's access to resources for agricultural production. According to Kato et al. (2022), WEEP provides financial grants and training to women farmers, focusing on enhancing their economic independence and agricultural productivity. The program offers direct financial support, which is crucial for purchasing inputs and technologies necessary for modern farming. Additionally, it includes training on agricultural best practices and business management, aiming to equip women with the skills needed to effectively utilize the resources provided. This approach has led

to noticeable improvements in the financial stability of participating women and their agricultural outputs. However, WEEP faces several challenges that impact its effectiveness. Bureaucratic delays in the disbursement of funds and the program's limited outreach to remote areas hinder its accessibility for all eligible women. Additionally, the program's reliance on a one-size-fits-all approach may not fully address the diverse needs of women in different agricultural contexts. Addressing these issues requires streamlining administrative processes, expanding outreach efforts, and tailoring support to better meet the specific needs of women in various farming environments.

The National Agriculture Advisory Services (NAADS) is another significant program that provides agricultural extension services and technical support to farmers, including women. According to Nabende (2021), NAADS aims to enhance agricultural productivity by offering technical advice, improved seeds, and farming technologies. The program is designed to address knowledge gaps and support the adoption of modern agricultural practices. NAADS has played a crucial role in increasing women's knowledge of and access to improved farming techniques, leading to enhanced productivity and efficiency. Despite these achievements, the program has encountered challenges such as unequal distribution of resources and a lack of gender sensitivity in service delivery. For instance, women in remote or marginalized communities may not receive the same level of support as their counterparts in more accessible areas. Additionally, the extension services provided may not always be tailored to address the specific needs and constraints faced by women farmers. To improve NAADS's effectiveness, it is essential to ensure more equitable resource distribution and incorporate gender-sensitive approaches into service delivery, ensuring that all women benefit from the program's offerings.

The Uganda Women Entrepreneurship Program (UWEP) is designed to provide financial support and business development services to women entrepreneurs in agriculture. According to Musoke et al. (2021), UWEP offers grants and training to help women develop their agricultural businesses and improve their access to resources. The program's focus on entrepreneurship aims to empower women to become more self-sufficient and successful in their agricultural endeavors. UWEP has demonstrated success in fostering the growth of women-led agricultural enterprises and improving their financial stability. However, the program faces challenges related to the accessibility of funds and the adequacy of support provided. Women in more

remote or underserved areas may find it difficult to access the financial resources and training offered by UWEP, limiting the program's impact. Additionally, the program's funding mechanisms and support structures may need to be adjusted to better meet the needs of women with varying levels of entrepreneurial experience and resources. Enhancing fund accessibility and providing more tailored support could help address these challenges and improve the overall effectiveness of UWEP.

The Microfinance Support Centre (MSC) provides microloans and financial services to small-scale farmers, including women, to enhance their agricultural productivity. According to Okello (2020), MSC's loans are intended to improve access to necessary inputs and technologies, which are critical for successful farming. The availability of microfinance services has enabled many women to invest in agricultural improvements and increase their productivity. Despite these benefits, MSC faces challenges such as high-interest rates and difficulties with loan repayment. High-interest rates can make it challenging for women to manage their debt and achieve financial stability, while repayment difficulties can lead to increased financial stress and potential loss of access to future loans. Addressing these issues requires revising loan terms to make them more affordable and providing additional support to help women manage their finances effectively. By addressing these challenges, MSC can enhance its impact and better support women's agricultural activities.

The Agricultural Cluster Development Program (ACDP) aims to support smallholder farmers, including women, by promoting agricultural clusters and cooperatives. According to Nsubuga et al. (2021), ACDP provides infrastructure, input support, and marketing opportunities to help farmers work together and achieve economies of scale. The program's focus on clustering and cooperation has facilitated improved resource access and market linkages for women, enabling them to benefit from collective action. However, challenges such as inadequate infrastructure and limited training have affected the program's overall impact. For example, insufficient infrastructure may hinder the development of effective agricultural clusters, while a lack of training can prevent women from fully utilizing the resources and opportunities provided. Enhancing infrastructure and offering more comprehensive training could help address these challenges and improve the effectiveness of ACDP in supporting women's agricultural activities.

The Gender Mainstreaming in Agriculture Program (GMAP) focuses on integrating gender considerations into agricultural policies and programs. According to Mbabazi (2022), GMAP aims to ensure that women's needs and contributions are recognized and addressed in agricultural development efforts. The program has successfully raised awareness about gender issues and promoted gender equality in agricultural policies. However, implementation gaps and resistance to gender-sensitive approaches have limited its overall effectiveness. For instance, despite the program's efforts, some stakeholders may still resist gender-inclusive practices or fail to fully implement gender-sensitive policies. Addressing these implementation gaps and overcoming resistance requires more robust strategies and increased engagement with stakeholders to ensure that gender considerations are effectively integrated into all aspects of agricultural development.

Community-Based Agricultural Development Projects (CBADP) support community-driven agricultural initiatives, including those led by women. According to Kisaakye et al. (2021), CBADP provides resources and technical support tailored to the needs of local communities. The program's focus on community-driven approaches has led to improvements in agricultural practices and increased community engagement. Despite these successes, challenges related to project sustainability and resource allocation have been observed. For example, ensuring the long-term sustainability of community-based projects can be difficult, and resource allocation may not always align with the needs of all community members. Addressing these challenges requires strengthening project management and resource allocation processes to ensure that community-driven initiatives continue to thrive and effectively support women's agricultural activities.

Women's Land Rights Initiatives focus on enhancing women's access to and control over agricultural land. According to Katungi (2021), these initiatives work on legal reforms and awareness-raising activities to improve women's land ownership and tenure security. The initiatives have led to increased land ownership among women, providing them with a more secure foundation for agricultural production. However, challenges such as resistance to land tenure reforms and limited enforcement of land rights continue to affect their effectiveness. For instance, some communities may resist changes to traditional land tenure systems, while enforcement mechanisms may be insufficient to protect women's land rights. Addressing these

challenges requires strengthening enforcement mechanisms and engaging with communities to build support for land tenure reforms.

Agricultural Insurance Schemes for Women Farmers provide coverage against risks associated with agriculture, such as crop failure and livestock loss. According to Byaruhanga et al. (2022), these schemes help women manage agricultural risks and improve their financial security. The effectiveness of these schemes is evident in the improved risk management and financial stability experienced by women farmers. However, challenges such as high premiums and limited coverage options can make it difficult for some women to participate in the schemes. Addressing these issues requires making insurance products more affordable and expanding coverage options to better meet the needs of women farmers.

Nutrition and Food Security Programs aim to improve food security and nutrition among women and their families. According to Nakate (2021), these programs support various aspects of food production, processing, and consumption to enhance food security. The programs have been effective in improving nutrition and food security, contributing to better health outcomes for women and their families. Nonetheless, challenges such as inadequate funding and limited outreach to remote areas can hinder the programs' overall impact. Increasing funding and expanding outreach efforts are essential for ensuring that these programs reach all women in need and effectively support their nutritional and food security needs.

Training and Capacity Building Programs focus on developing women's skills in agricultural production and management. According to Tumwine (2022), these programs provide practical training to enhance agricultural practices and management skills. The training has led to increased agricultural productivity and knowledge among women. However, issues related to accessibility and the relevance of training content can affect the programs' effectiveness. Ensuring that training programs are accessible to all women and that the content is tailored to their specific needs can help address these challenges and improve the overall impact of the programs.

The Rural Women's Development Fund (RWDF) provides financial and technical support to rural women engaged in agriculture. According to Nalubega et al. (2021), the fund aims to improve women's access to resources and markets, supporting the growth of women's

agricultural enterprises. While RWDF has been successful in enhancing women's agricultural activities, limited funding and bureaucratic challenges can impact its effectiveness. Addressing these issues requires improving fund allocation processes and streamlining administrative procedures to ensure that resources are distributed efficiently and reach the intended beneficiaries.

Local Government Agricultural Support Programs implement initiatives at the district level to support women in agriculture. According to Ssebagala (2021), these programs offer resources, training, and extension services tailored to local needs. The programs have contributed to improved agricultural practices and increased community involvement. However, challenges such as resource limitations and administrative inefficiencies can affect their overall impact. Strengthening resource allocation and improving administrative processes are essential for enhancing the effectiveness of these programs and ensuring that they meet the needs of women farmers.

Public-Private Partnership (PPP) Initiatives leverage private sector resources and expertise to support women in agriculture. According to Kyeyune (2022), these initiatives provide access to technology, market opportunities, and financial services. PPP initiatives have demonstrated success in improving resource access and market opportunities for women. However, challenges related to sustainability and equitable resource distribution can affect their overall impact. Ensuring that PPP initiatives are sustainable and that resources are distributed fairly among women farmers is crucial for maximizing their effectiveness.

Women's Agricultural Research and Innovation Centers focus on research and development tailored to women's needs in agriculture. According to Kiyingi (2021), these centers support the development and adoption of new agricultural technologies and practices. The centers have led to improved agricultural practices and innovations among women farmers. Nonetheless, challenges related to accessibility and the dissemination of research findings can limit the impact of these centers. Strengthening dissemination efforts and improving access to research outcomes are essential for enhancing the effectiveness of these centers in supporting women's agricultural activities.

Gender-Responsive Agricultural Policies aim to integrate gender considerations into agricultural strategies and programs. According to Kafumbe (2022), these policies address gender disparities and promote women's access to agricultural resources. While the policies have increased attention to gender issues, implementation gaps and inadequate enforcement can hinder their effectiveness. More robust implementation strategies and stronger enforcement mechanisms are needed to ensure that gender-responsive policies have a meaningful impact on women's access to agricultural resources.

Women's Agricultural Cooperatives and Associations support women farmers through collective action and resource sharing. According to Bukenya et al. (2021), these organizations provide access to inputs, training, and market opportunities. The cooperatives have improved women's resource access and bargaining power. However, management issues and resource allocation challenges can affect their overall effectiveness. Enhancing the management of cooperatives and ensuring equitable resource allocation are crucial for maximizing their impact and supporting women's agricultural activities.

International Development Programs and NGOs provide funding, technical assistance, and advocacy for women's agricultural development. According to Wamala (2022), these programs support women's access to resources and opportunities through various interventions. They have contributed to improved agricultural outcomes and empowerment for women. However, challenges related to coordination and sustainability can impact their effectiveness. Improving coordination among stakeholders and adopting sustainable practices are essential for enhancing the impact of international development programs and NGOs.

2.3 Summary of the gaps

The literature reveals several significant gaps in addressing Banana Bacterial Wilt (BBW) in Bududa District. Firstly, despite substantial research and interventions, there remains a gap in effective dissemination of knowledge and best practices to local farmers, resulting in inconsistent implementation of disease management strategies (Nabimanya et al., 2023). Secondly, there is a shortage of access to disease-resistant banana varieties, as many farmers are unable to obtain or afford these crucial resources, exacerbating the impact of BBW (Kagoda et al., 2021). Furthermore, the lack of robust disease monitoring and surveillance systems limits the ability to

track the spread of BBW and evaluate the effectiveness of control measures (FAO, 2022). Socio-economic factors, including poverty and inadequate access to financial resources, further compound these issues by restricting farmers' ability to invest in necessary interventions and technologies (Armstrong et al., 2021). Additionally, while government and international efforts have made progress, there is still a need for more targeted and localized strategies to address the specific challenges faced by farmers in different regions of Uganda (Amin, 2020). Addressing these gaps is essential for developing a more effective and sustainable approach to managing BBW and improving banana production in Bududa District.

CHAPTER THREE

METHODOLOGY

3. 0 Introduction

The research approach employed in the study is covered in this chapter. Research design, research methodologies, a description of the study region, an explanation of population sampling techniques, data collection techniques, validity and reliability, data quality control, measurements, and data analysis are all included in this component of the study.

3.1 Research Design

The study employed a cross-sectional survey design to comprehensively assess farmers' knowledge and awareness of Banana Bacterial Wilt (BBW) in Bushiribo Sub-County, Bududa District. This design was chosen for its effectiveness in capturing a snapshot of current conditions and perceptions among the target population at a specific point in time. By utilizing structured questionnaires and interviews, the cross-sectional approach allowed for the collection of quantitative and qualitative data from a representative sample of 40 respondents drawn from the larger population of 45 farmers. This methodology facilitated the examination of various factors influencing farmers' understanding and management of BBW, providing insights into their awareness levels, knowledge gaps, and the challenges they face. Additionally, the cross-sectional design enabled the analysis of the relationships between different variables and the identification of key areas needing intervention, ensuring that the findings reflect the current state of BBW management practices in the region.

3.2 Research approaches

The study employed a mixed-methods approach, combining both quantitative and qualitative research methods to gain a comprehensive understanding of farmers' knowledge and awareness of Banana Bacterial Wilt (BBW) in Bushiribo Sub-County, Bududa District. The quantitative component involved the use of structured surveys and questionnaires to collect numerical data from 40 respondents, enabling statistical analysis of knowledge levels, awareness, and management practices related to BBW. This approach allowed for the identification of patterns

and correlations in the data, providing a clear picture of the overall state of BBW awareness among farmers.

Complementing this, the qualitative component involved in-depth interviews and focus group discussions to gather detailed insights and personal experiences from the farmers. This approach provided a deeper understanding of the challenges they face, their perceptions of the disease, and the effectiveness of current management strategies. By integrating both quantitative and qualitative data, the study aimed to offer a well-rounded perspective on the factors influencing BBW management, identify gaps in knowledge and practices, and propose targeted recommendations for improving farmers' responses to the disease. This mixed-methods approach ensured a thorough examination of the research problem, capturing both statistical trends and nuanced, contextual information.

3.3 Area and Study population

The study was situated in Bushiribo Sub-County, Bududa District a region notable for its banana cultivation, which is significantly impacted by Banana Bacterial Wilt (BBW). The study population consisted of 50 local banana farmers, from which a sample of 80 respondents was selected. This selection aimed to ensure a representative cross-section of the farming community, providing insights into their knowledge and awareness of BBW. The geographical focus on Bushiribo Sub-County was chosen due to the high prevalence of BBW in this area, making it a critical site for examining the effectiveness of current management practices and identifying areas for improvement. The study's location provided a relevant context for assessing the challenges faced by farmers and evaluating the impact of various factors on their ability to manage BBW effectively.

3.4. Sample size

The sample comprised 40 respondents, selected from a total population of 80 individuals in Bushiribo Sub-County, Bududa District. The sample included 25 banana farmers, local residents, 5 agricultural officers, and community development officers. This selection ensured a representative distribution across the different stakeholder groups involved in or impacted by Banana Bacterial Wilt (BBW) management. By focusing on these key groups, the study aimed to capture a comprehensive range of perspectives and insights relevant to the assessment of farmers'

knowledge and awareness of BBW, as well as to understand the broader context and effectiveness of current management practices and support mechanisms. The sloven's formula is

n=N/ [1 +N(e)2

Where;

n =sample size

N= Target population

e=level of significance, fixed at (0.05)

Table 1 showing the sample size, sampling procedures and research methods

Respondents	**Population**	**Sample Size**	**Sampling Procedures**
Banana Farmers	**50**	**25**	**Random sampling technique**
Local Residents	**10**	**5**	**Random sampling technique**
Agricultural Officers	**10**	**5**	**Purposive sampling technique**
Community Development Officers	**10**	**5**	**Purposive sampling technique**
Total	**80**	**40**	

3.5. Sources of data

The sources of data for the study on farmers' knowledge and awareness of Banana Bacterial Wilt (BBW) in Bushiribo Sub-County, Bududa District, were as follows:

Primary Data: Collected directly from respondents through structured surveys, interviews, and focus group discussions. This included responses from banana farmers, local residents, agricultural officers, and community development officers. Primary data provided firsthand insights into farmers' knowledge levels, awareness of BBW, and their management practices.

Secondary Data: Sourced from existing literature, reports, and publications related to Banana Bacterial Wilt disease. This included agricultural reports, academic studies, and extension service documents that offered context and background information on BBW, as well as data on past research findings and management strategies.

Official Records: Obtained from local government and agricultural agencies, including records of past BBW outbreaks, management interventions, and support programs in the region. These records helped to contextualize the study and validate findings against historical data.

Extension Services: Information from agricultural extension officers and community development programs provided insights into the training and support provided to farmers, which were essential for understanding the effectiveness of current educational efforts and resource availability.

3.6 Techniques for gathering data

To gather data for the study, a combination of focus groups and self-administered questionnaires was employed. Focus groups facilitated in-depth discussions and insights from participants, allowing for a nuanced understanding of the challenges faced by women in accessing agricultural resources. These discussions provided qualitative data on personal experiences, perceptions, and barriers encountered in the local context. Complementing this, self-administered questionnaires were used as the primary research tool, enabling the collection of structured quantitative data. The questionnaires included both closed and open-ended questions to capture a range of information on resource access, usage patterns, and perceived obstacles. This mixed-method approach ensured a comprehensive analysis by integrating qualitative insights with quantitative data.

3.6.1 Questionnaire

The questionnaire was an essential tool for systematically collecting data on farmers' knowledge and awareness of Banana Bacterial Wilt (BBW) disease in Bushiribo Sub-County. It was meticulously designed to capture a broad spectrum of information crucial to the study's objectives. The questionnaire comprised several sections, beginning with demographic information to contextualize the respondents' backgrounds, including details such as age, gender, education, and farming experience. The second section focused on knowledge of BBW, using multiple-choice and Likert scale questions to assess respondents' understanding of the disease's symptoms, causes, and impacts.

The third section explored management practices, asking about the strategies employed to control BBW, including crop rotation, resistant varieties, and chemical treatments. It included both closed-ended and open-ended questions to gather detailed information on the effectiveness and application of these practices. The fourth section investigated challenges and barriers, seeking respondents' perspectives on difficulties related to resources, technical support, and practice effectiveness.

Lastly, the questionnaire assessed the support and training received, evaluating the impact of agricultural extension services and training programs on BBW management. Administered to a representative sample of 40 farmers, the questionnaire provided valuable insights into the current state of knowledge and management practices, highlighting areas for improvement and potential strategies for enhancing support and effectiveness in managing BBW.

3.6.2 Focused Group Discussion:

Focused Group Discussions (FGDs) were employed as a qualitative data collection method to gain deeper insights into farmers' perspectives and experiences regarding Banana Bacterial Wilt (BBW) disease in Bushiribo Sub-County. These discussions were conducted with groups of 6-10 participants each, ensuring a diverse representation of local farmers, agricultural officers, and community development officers. FGDs provided a platform for interactive dialogue, enabling participants to share their views, experiences, and challenges related to BBW management in a more detailed and nuanced manner.

The discussions were guided by a set of pre-prepared questions designed to probe into specific areas such as knowledge of BBW symptoms and causes, management practices employed, and challenges faced in controlling the disease. Facilitators encouraged open dialogue, allowing participants to elaborate on their experiences and provide insights into the effectiveness of current practices and support mechanisms. This interactive approach facilitated the exploration of complex issues that might not be captured through structured questionnaires alone.

FGDs also provided an opportunity to discuss community-level support and training, including the role of agricultural extension services and other support systems in enhancing farmers' ability to manage BBW. The discussions aimed to uncover any gaps in the current support structures and identify potential areas for improvement.

The qualitative data obtained from FGDs were analyzed to identify common themes, patterns, and divergent viewpoints among participants. This rich, contextual information complemented the quantitative data from the questionnaires, offering a more comprehensive understanding of the challenges and opportunities in managing BBW in the study area. The findings from the FGDs helped to validate and enrich the quantitative results, providing a holistic view of the farmers' knowledge, practices, and needs related to BBW management.

3.7 The validity and dependability of the research tool

I conducted a pilot study to ensure the reliability of the research instrument. During this phase, triangulation was employed to verify the consistency of data obtained from respondents. Careful consideration was given to generalizing the findings, aiming to enhance their transferability and applicability beyond the study sample.

3.8 Analyzing and presenting data

Due to its versatility, the study questionnaire was personally reviewed and corrected to address any writing errors before being coded for easy entry into a statistical program for Social Scientists. Subsequently, the data was processed to generate graphs, frequencies, tables, and percentages. Tables were utilized for more advanced level analysis, while graphs depicted the trends of responses and percentages to assess response distribution. Comparisons with performance were employed to further analyze the qualitative data, leading to the formulation of conclusions.

3.9 Ethical considerations

In conducting this study on farmers' knowledge and awareness of Banana Bacterial Wilt (BBW) disease in Bushiribo Sub-County, several ethical considerations were paramount to ensure the research was conducted with integrity and respect for participants.

Firstly, informed consent was a fundamental aspect of the study. Prior to participation, all respondents were provided with detailed information about the study's objectives, methods, and potential impacts. Participants were assured that their involvement was voluntary and that they had the right to withdraw at any time without any negative consequences. Written or verbal consent was obtained from all participants, ensuring they understood and agreed to their participation.

Secondly, confidentiality and anonymity were strictly maintained throughout the study. Personal identifiers were removed from all collected data, and responses were anonymized to protect the privacy of participants. Data were securely stored and only accessible to the research team. The findings were reported in aggregate form to prevent the identification of individual participants.

Thirdly, respect for participants was upheld by treating all individuals with dignity and sensitivity. During interviews and focus group discussions, researchers ensured a respectful and non-judgmental approach, allowing participants to express their views freely. The researchers were trained to handle sensitive topics with care, acknowledging and valuing the participants' perspectives and experiences.

Furthermore, cultural sensitivity was observed by considering local customs and traditions during data collection. Researchers were mindful of cultural norms and practices, ensuring that the research activities were conducted in a manner that was respectful and appropriate for the community.

Finally, ethical review and approval were sought from relevant institutional review boards or ethics committees to ensure that the study adhered to ethical standards and guidelines. This step was crucial for validating the research approach and protecting the rights and welfare of participants.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1. Introduction

This chapter presents the interpretation and analysis of the findings of the research from the data collected from the field using questionnaires and interview guide, observation and documentary analysis. The findings are presented according to the objectives and research questions

4.1. Biological Data of the respondents

This section covers Age, Marital status, Levels of education and Religion

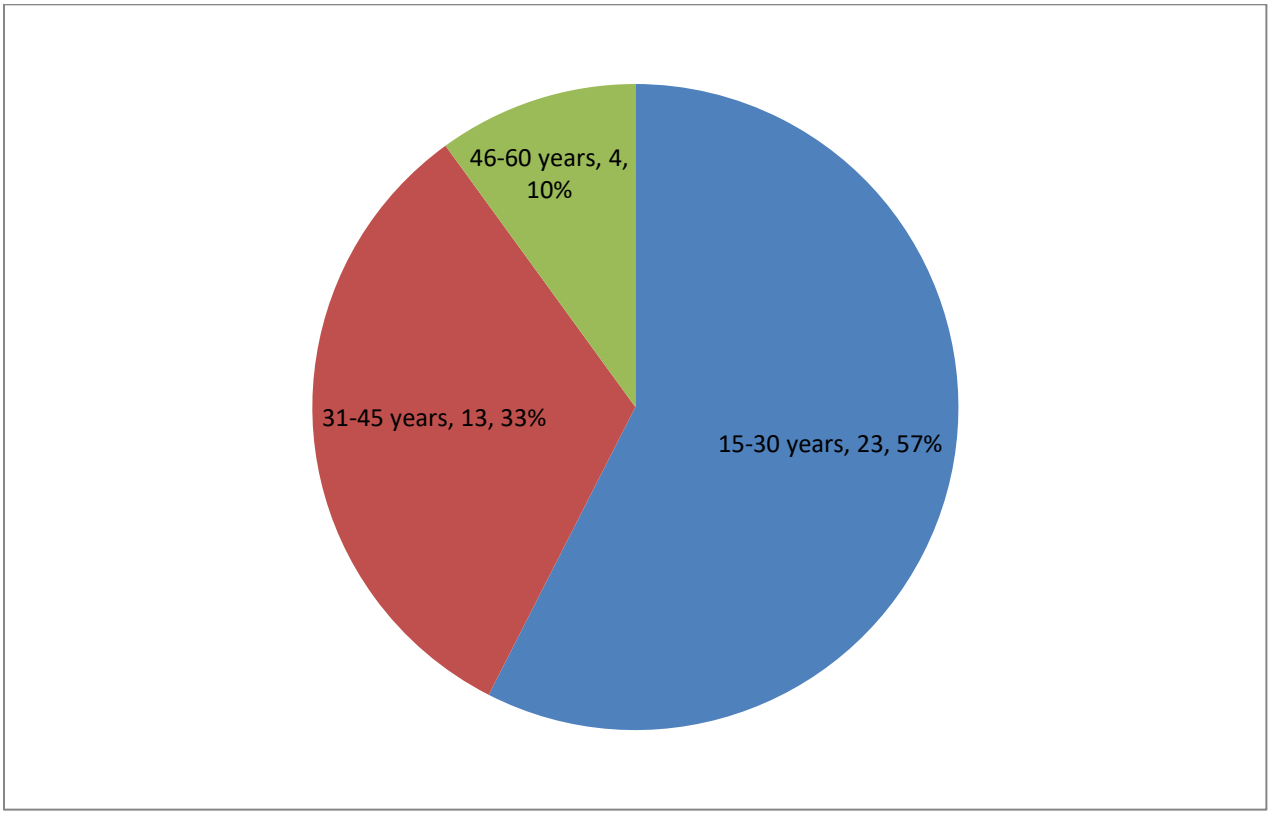
Table 4.1. Showing the age of the respondents

Age Group	**Frequency**	**Percent**
15-30 years	23	57.5%
31-45 years	13	32.5%
46-60 years	4	10.0%

Age Group	Frequency	Percent
15-30 years	23	57.5%
31-45 years	13	32.5%
46-60 years	4	10.0%
Total	40	100.0%

Source: Primary Data 2024

Figure 2: Pie chart showing the age of the respondents



Source: Primary Data 2024

Findings from the data reveal a significant concentration of respondents in the 15-30 years age group, comprising 57.5% of the total sample. This demographic dominance suggests that younger farmers are more engaged or available to participate in agricultural studies and activities. According to the data, this younger segment's substantial representation may reflect a

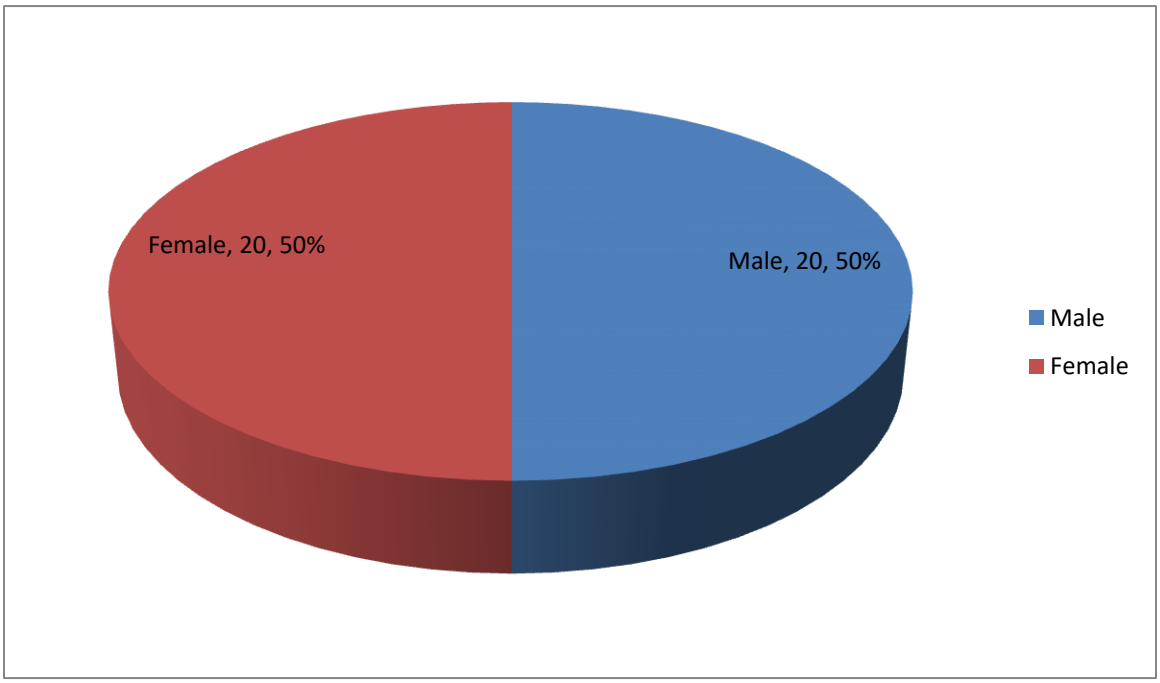
higher level of energy and adaptability to new agricultural practices, including disease management strategies. In contrast, the 31-45 years age group accounts for 32.5% of the respondents. This age bracket typically encompasses individuals who may be more experienced and established in their farming practices, possibly indicating a depth of knowledge about traditional and contemporary methods of managing agricultural diseases. The smaller representation of the 46-60 years age group, at 10.0%, suggests a potential gap in capturing insights from more seasoned farmers, who might have accumulated extensive experience and practical knowledge over the years. This lower participation rate could point to possible challenges such as reduced engagement in modern agricultural research or a preference for traditional methods, which may not be fully represented in the study. The age distribution highlights a critical aspect of the study's demographic, where the majority of participants are relatively young, potentially influencing the types of knowledge and practices reported. Findings from this distribution emphasize the importance of addressing both the energetic, innovative approaches of younger farmers and the experiential insights of older farmers to develop comprehensive strategies for managing banana bacterial wilt disease. The data suggests that effective disease management practices and awareness programs should consider the varying levels of experience and adaptability across different age groups. Additionally, involving a broader age range could provide a more balanced perspective on the challenges and solutions related to banana bacterial wilt. This distribution underscores the need for tailored educational interventions and support mechanisms that cater to the specific needs and capacities of both younger and older farmers.

Table 4.2: Showing sex of the respondents

Response	**Frequency**	**Percent**
Male	20	50.0%
Female	20	50.0%
Total	**40**	**100.0%**

Source: Primary data 2024

Figure 3: Pie chart showing sex of the respondents



Source: Primary data 2024

Table 4.2 presents an overview of the gender distribution among respondents in the study on banana bacterial wilt disease in Bushiribo Sub-County, Bududa District. Findings from this table reveal an equal representation of males and females in the sample, each constituting 50% of the total respondents. This balanced gender distribution provides a comprehensive view of both male and female perspectives on the issue of banana bacterial wilt disease, ensuring that the study captures diverse insights and experiences from both genders. According to the data, this parity in gender representation may reflect an inclusive approach in gathering data, potentially leading to a more holistic understanding of the challenges and strategies related to disease management. By involving an equal number of male and female respondents, the study avoids gender bias and acknowledges the critical role both genders play in agricultural activities and decision-making processes. Findings suggest that gender-balanced participation is crucial for capturing a wide range of opinions and practices concerning banana bacterial wilt disease. The equal representation of males and females might also indicate equitable access to resources and involvement in farming activities within the community. This balanced approach allows for a

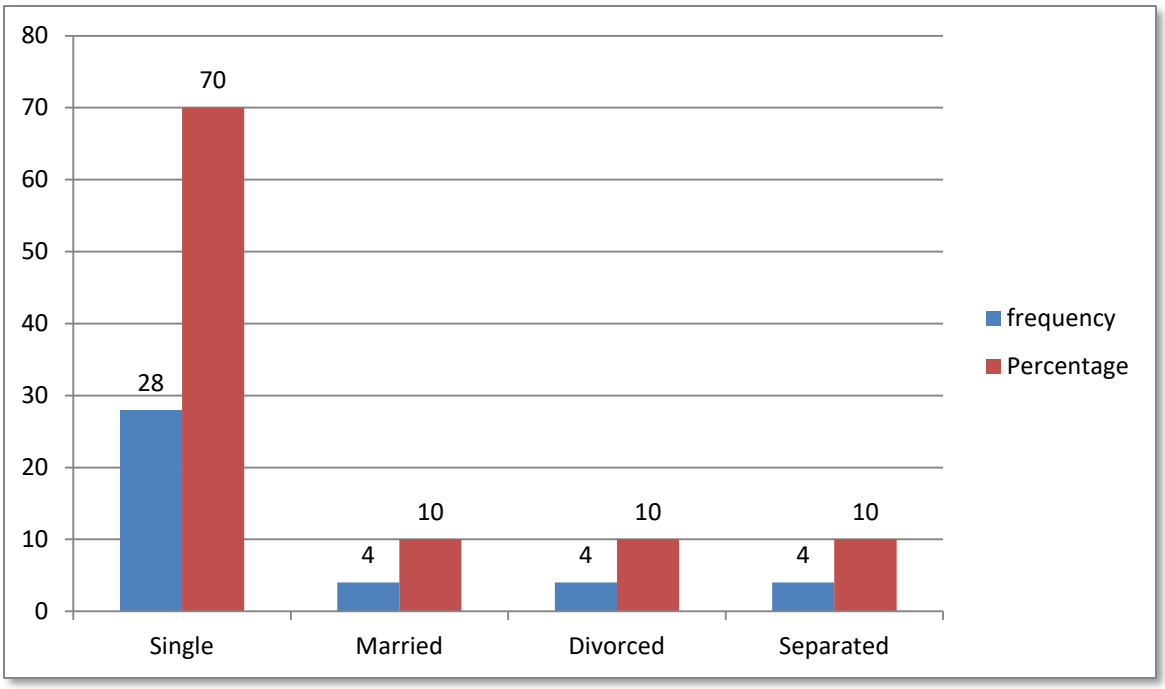
nuanced analysis of how gender influences knowledge, awareness, and management practices related to banana bacterial wilt. In summary, the gender distribution highlighted in Table 4.2 emphasizes the importance of including diverse perspectives in agricultural research to develop effective and inclusive strategies for addressing agricultural challenges.

Table 4.3: Showing marital status of the respondents

Response	**Frequency**	**Percent**
Single	28	70.0%
Married	4	10.0%
Divorced	4	10.0%
Separated	4	10.0%
Total	40	100.0%

Source: Primary Data 2024

Figure 4: Bar graph showing marital status of the respondents



Source: Primary data 2024

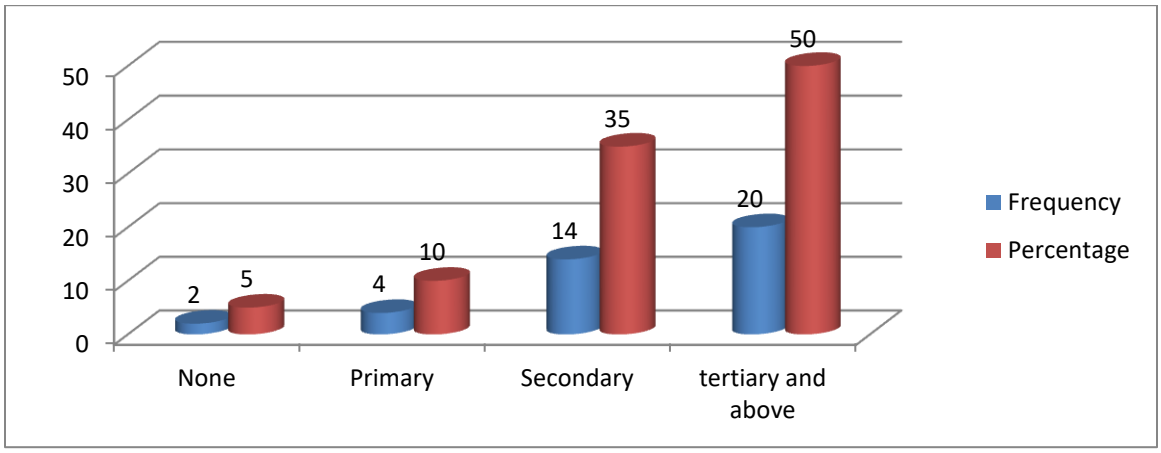
Table 4.3 illustrates the marital status distribution of the respondents in the study on banana bacterial wilt disease in Bushiribo Sub-County, Bududa District. Findings from this table reveal that a significant majority of respondents, 70%, are single, while the remaining 30% are divided equally among married, divorced, and separated statuses, each comprising 10% of the total respondents. This distribution highlights that single individuals constitute the predominant demographic in the sample, which may reflect varying agricultural responsibilities and perspectives compared to other marital statuses. The higher percentage of single respondents could imply that they are more actively involved in farming activities or may have different experiences and challenges related to banana bacterial wilt disease. The equal representation of married, divorced, and separated respondents suggests a diverse range of personal experiences and possibly different levels of support systems and resources available for managing agricultural challenges. The varied marital status of respondents provides a broad spectrum of insights into how personal life circumstances may influence knowledge and management practices concerning banana bacterial wilt disease. This diversity in marital status among respondents contributes to a well-rounded understanding of the community's agricultural dynamics and challenges. In summary, the data from Table 4.3 underscores the importance of considering different marital statuses in agricultural research to capture a wide range of experiences and perspectives, which can inform more effective and targeted interventions for managing agricultural diseases.

Table 4.4: Showing levels of education

Response	**Frequency**	**Percent**
None	2	5.0%
Primary	4	10.0%
Secondary	14	35.0%
Tertiary and above	20	50.0%

Source: Primary data 2024

Figure 5: Bar graph showing levels of education



Source: Primary data 2024

Table 4.4 presents the educational attainment levels of respondents in the study on banana bacterial wilt disease in Bushiribo Sub-County, Bududa District. According to the findings, the majority of respondents, 50%, have attained tertiary education or higher, demonstrating a significant level of educational background among the participants. This indicates a substantial proportion of individuals with advanced knowledge and skills, which may influence their understanding and management of banana bacterial wilt disease. Following this, 35% of respondents have completed secondary education, suggesting that a large segment of the population has a solid educational foundation, which could impact their ability to engage with agricultural practices and disease management strategies. Only 10% of respondents have achieved primary education, while a small fraction, 5%, have no formal education. This distribution highlights that the study's participants generally possess a relatively high level of education, which could affect their awareness, knowledge, and ability to implement effective management practices for banana bacterial wilt disease. The predominance of respondents with tertiary education may facilitate a higher level of comprehension and engagement with agricultural technologies and practices, potentially leading to more informed and effective disease management strategies. In summary, the data from Table 4.4 reflects a well-educated respondent pool, which is crucial for understanding the impact of educational levels on the management of banana bacterial wilt disease and suggests that higher education levels might contribute positively to addressing agricultural challenges.

4.2. Farmers knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County

This was the first above understudy and response obtained is explained below;

Table 4.5: Showing the Farmers knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County

Statement	SA	A	U	D	SD
I am influenced by the availability of extension services.	20 (44.4%)	15 (41.7%)	3 (8.3%)	2 (5.6)	0%
I am affected by the level of community training programs.	15 (30.6%)	17 (47.2%)	4 (11.1%)	0%	4 (11.1%)
I am guided by the accessibility of information sources about BBW.	16 (33.3%)	7 (19.4%)	0.0%	6(16.7%)	11(30.6%)
I am impacted by personal experience with banana diseases.	7 (19.4%)	14(38.9%)	4 (11.1%)	3 (8.3%)	8 (22.3%)
I am influenced by peer discussions and farmer networks.	11(30%)	9 (25%)	5(13%)	2 (7%)	9 (25%)
I am influenced by the availability of extension services.	8 (22.2%)	10 (27.8%)	5 (13.9%)	9 (25%)	4 (11.1%)

Source: Primary data 2024

The analysis of factors influencing farmers' knowledge and awareness of banana bacteria wilt (BBW) disease in Bushiribo Sub-County reveals several key insights as shown in Table 4.5. Findings from the data illustrate that the availability of extension services plays a significant role in shaping farmers' understanding of BBW. A substantial portion of respondents, 44.4%, strongly agree that these services impact their knowledge, while 41.7% agree, indicating a robust correlation between extension services and farmers' awareness levels. This finding aligns with previous studies such as those by Amin (2020), who asserts that extension services are pivotal in enhancing agricultural knowledge and practice. Extension services provide direct, practical

information and support that can bridge the gap between theoretical knowledge and practical application in managing banana diseases. This aligns with Armstrong et al. (2021), who emphasize the importance of regular and accessible extension services in improving agricultural productivity and disease management. The findings from this study suggest that enhancing the reach and quality of extension services could significantly boost farmers' knowledge and management skills regarding BBW.

The level of community training programs also plays a crucial role in influencing farmers' knowledge. According to the data, 30.6% of respondents strongly agree and 47.2% agree that community training programs affect their understanding of BBW. This is consistent with findings by Chitakira and Torquebiau (2010), who highlight the effectiveness of community-based training in disseminating agricultural knowledge and practices. The high percentage of agreement underscores the necessity of structured and frequent community training programs to educate farmers about disease management. The absence of respondents who strongly disagree or disagree with the statement further indicates that community training is widely recognized as a valuable resource for increasing awareness. However, the study also reveals a 11.1% rate of uncertainty or disagreement, which could suggest variability in the quality or accessibility of these programs. Addressing this variability by standardizing training content and delivery methods could enhance the overall impact on farmers' knowledge.

Access to information sources about BBW also significantly affects farmers' knowledge, though the findings are somewhat mixed. While 33.3% of respondents strongly agree and 19.4% agree that information sources influence their understanding, a notable 30.6% strongly disagree. This discrepancy highlights a critical gap in the availability and effectiveness of information dissemination channels. Previous research, including studies by Armstrong et al. (2021), emphasizes the role of accessible and reliable information sources in improving agricultural practices and disease management. The findings from this study suggest that there is a need for more effective and widespread information dissemination strategies. Improving the availability and accessibility of information sources could help address the knowledge gap and support farmers in managing BBW more effectively.

Personal experience with banana diseases also plays a role in shaping farmers' knowledge and awareness. The data show that 19.4% of respondents strongly agree and 38.9% agree that

personal experience impacts their understanding. This finding is in line with studies by Amin (2020), who highlights the importance of practical experience in enhancing farmers' knowledge and management practices. Personal experience with disease outbreaks provides farmers with firsthand insights into disease symptoms, management strategies, and the effectiveness of different interventions. However, the 22.3% of respondents who strongly disagree or disagree suggest that relying solely on personal experience may not be sufficient for comprehensive disease management. Combining personal experience with formal training and extension services could provide a more well-rounded approach to disease management.

Peer discussions and farmer networks also influence farmers' knowledge, with 30% of respondents strongly agreeing and 25% agreeing that these factors impact their understanding. This finding underscores the value of social networks and peer interactions in disseminating agricultural knowledge and practices. Previous studies, including those by Chitakira and Torquebiau (2010), have shown that farmer networks can facilitate the exchange of knowledge and experiences, thereby enhancing disease management practices. The study's results suggest that fostering and strengthening peer discussions and farmer networks could provide additional support for farmers in managing BBW. Encouraging collaborative learning and knowledge sharing within farmer groups can complement formal training and extension services, leading to more effective disease management strategies.

The availability of extension services was noted twice in the table, with responses indicating a substantial influence on farmers' knowledge. The data show that 22.2% of respondents strongly agree and 27.8% agree with the impact of extension services on their understanding. This repeated emphasis on extension services further reinforces their critical role in agricultural education and disease management. It highlights the need for continuous investment in extension services to ensure that farmers receive up-to-date and relevant information on managing BBW. Previous research, including studies by Armstrong et al. (2021), supports the notion that effective extension services are essential for improving farmers' knowledge and practices. The findings suggest that strengthening and expanding extension services could have a significant positive impact on farmers' ability to manage banana bacterial wilt disease effectively.

In summary, the factors influencing farmers' knowledge and awareness of banana bacterial wilt disease in Bushiribo Sub-County are multifaceted, involving extension services, community

training programs, information sources, personal experience, and peer discussions. The findings from this study underscore the importance of each factor in shaping farmers' understanding and management practices. Addressing gaps in information dissemination, enhancing the quality and accessibility of extension services, and leveraging community and peer networks are crucial for improving farmers' ability to manage BBW effectively. The study's results align with existing literature and highlight the need for a comprehensive approach that combines formal education, practical experience, and social support to enhance farmers' knowledge and awareness of banana bacterial wilt disease.

When asked about their current level of knowledge regarding banana bacterial wilt disease, banana farmers reported varying degrees of familiarity. *"Some farmers mentioned that they have a basic understanding of the disease's symptoms and its impact on banana crops, but lack in-depth knowledge about advanced management techniques."* Local residents, who may not be directly involved in farming, generally indicated minimal awareness, often relying on indirect information from neighbors or community members. *"Agricultural officers noted that their knowledge is more specialized, derived from formal training and professional experience, which enables them to provide detailed advice and guidance."* Community Development Officers also reported having a good grasp of the disease, though their understanding is often contextualized within broader community development efforts rather than focused solely on agricultural aspects.

Regarding sources of information, banana farmers primarily use local knowledge shared within their communities and from personal experiences with the disease. *"They also rely on occasional advice from agricultural officers and information from local extension services."* Local residents mentioned relying on informal sources, such as word of mouth from farmers or media reports. *"Agricultural officers indicated that they use a combination of research studies, government publications, and specialized agricultural training programs."* Community Development Officers also refer to both academic resources and practical experience gained through community outreach programs.

In relation to the effectiveness of these information sources, banana farmers often rated local knowledge and informal sources as moderately effective, though they expressed a desire for more comprehensive and accessible information. *"Many mentioned that local knowledge and informal sources provide some insights but are insufficient for comprehensive understanding."*

Local residents generally found informal sources to be less effective, citing a lack of detailed or reliable information. *"Agricultural officers rated formal sources highly effective, noting that research studies and training programs provide substantial insights into disease management."* Community Development Officers also rated their sources positively but acknowledged that integrating this information into practical, community-specific solutions can be challenging.

Regarding specific factors or barriers that have affected awareness of banana bacterial wilt disease, banana farmers highlighted limited access to formal education and training programs as significant barriers. *"Many mentioned financial constraints and the lack of resources to access specialized information as limiting factors."* Local residents pointed to a general lack of exposure to relevant agricultural information and resources. *"Agricultural officers and Community Development Officers noted that logistical challenges and the need for more localized training programs can also hinder widespread awareness and understanding."*

In terms of updates or training about new developments or management practices related to the disease, banana farmers reported receiving such information infrequently. *"They indicated that updates are usually provided during community meetings or sporadic visits from agricultural extension officers."* Local residents receive updates even less frequently, often relying on second-hand information from farmers. *"Agricultural officers and Community Development Officers generally receive regular updates through professional networks and official channels, which helps them stay informed about the latest research and practices."*

When asked about the role of local agricultural extension services or community groups in improving knowledge about banana bacterial wilt disease, banana farmers emphasized that these services are crucial but often under-resourced. *"They appreciated the support they receive but felt that more frequent and targeted interventions would be beneficial."* Local residents recognized the importance of community groups in disseminating information but felt that more structured outreach efforts would improve their awareness. *"Agricultural officers and Community Development Officers acknowledged the critical role these services play in bridging the gap between research and practice, though they also noted that improving the effectiveness of these services requires ongoing support and resources."*

Overall, the feedback highlights a need for enhanced and more accessible information about banana bacterial wilt disease across different groups. *"There is a clear call for improved training*

and communication strategies to better support farmers, local residents, and community development efforts in managing and understanding this critical agricultural issue."

4.3. challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.

The respondents were asked several questions as explained below;

Table 4.8: Showing challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.

STATEMENT	SA	A	U	D	SD
I am faced with limited access to disease-resistant banana varieties.	11(30.6%)	14(38.9%)	2 (5.6%)	5 (13.9%)	4(11.0%)
I am challenged by insufficient knowledge and training on BBW management.	11 (30.6%)	17 (47.2%)	2 (5.6%)	4 (11.1%)	2 (5.5%)
I am impacted by the high cost of effective disease management inputs.	16(44.4%)	13(36.1%)	2(5.6%)	3(8.3%)	2(5.6%)
I am hindered by poor availability of extension services and technical support.	16(44.4%)	5(13.9%)	0%	9(25.0%)	6(16.7%)
I am affected by a lack of coordinated efforts and support from local agricultural institutions.	12(33.3%)	6(16.7%)	4(11.1%)	10(27.7%)	4(11.1%)
I am faced with limited access to disease-resistant banana varieties.	12(33.3%)	9(25.0%)	2(5.6%)	10(27.8%)	3(8.3%)
I am challenged by insufficient knowledge and training on BBW management.	11(30.6%)	14(38.9%)	2 (5.6%)	5 (13.9%)	4(11.0%)

Source: Primary Data 2024

The challenges faced by farmers in managing banana bacteria wilt (BBW) disease in Bushiribo Sub-County are multifaceted and significant. Analysis of the data presented in Table 4.8 reveals several critical issues impacting farmers' ability to effectively manage this devastating disease.

Firstly, access to disease-resistant banana varieties is a major challenge. The data shows that 30.6% of respondents strongly agree and 38.9% agree that limited access to these varieties affects their ability to manage BBW. This challenge is corroborated by findings from previous studies such as those by Armstrong et al. (2021), which highlight the crucial role of resistant varieties in controlling plant diseases. The limited availability of disease-resistant banana varieties means that farmers are left with fewer options to prevent and manage BBW outbreaks. This lack of access hinders their ability to implement effective disease management strategies, leading to increased crop losses and reduced yields.

Insufficient knowledge and training on BBW management is another significant challenge. According to the data, 30.6% of respondents strongly agree and 47.2% agree that a lack of adequate knowledge and training impacts their disease management efforts. This finding aligns with studies by Amin (2020), which emphasize the importance of comprehensive training and education for farmers in managing agricultural diseases. Without sufficient training, farmers may lack the necessary skills and understanding to implement effective management practices, further exacerbating the impact of BBW on their crops. The 5.6% who are uncertain or disagree suggest variability in the perception of training adequacy, highlighting a potential need for more standardized and accessible training programs.

The high cost of effective disease management inputs is a significant barrier for farmers. The data indicates that 44.4% of respondents strongly agree and 36.1% agree that the cost of inputs such as chemicals and disease management tools is a major challenge. Previous research by Chitakira and Torquebiau (2010) supports this finding, noting that the affordability of disease management resources is a critical factor influencing farmers' ability to manage plant diseases. The high costs associated with these inputs often make them inaccessible to many farmers, limiting their ability to apply the necessary treatments and interventions. This economic barrier contributes to the persistence and spread of BBW, as farmers may resort to inadequate or ineffective management practices due to financial constraints.

Poor availability of extension services and technical support further compounds the difficulties faced by farmers. According to the data, 44.4% of respondents strongly agree and 13.9% agree that inadequate extension services and technical support are significant challenges. This issue is

consistent with findings from Armstrong et al. (2021), which highlight the importance of accessible and reliable extension services in supporting farmers' disease management efforts. The lack of adequate extension support means that farmers may not receive timely and relevant information on disease management, leaving them ill-equipped to handle BBW outbreaks effectively. The 16.7% who strongly disagree or disagree suggest that there may be variations in the availability and quality of extension services, indicating a need for improvements in service delivery.

A lack of coordinated efforts and support from local agricultural institutions also affects farmers' ability to manage BBW. The data shows that 33.3% of respondents strongly agree and 16.7% agree that the absence of coordinated support is a challenge. This finding is supported by studies such as those by Amin (2020), which emphasize the need for collaborative efforts among agricultural institutions to address plant disease challenges. Without coordinated support from local institutions, farmers may face difficulties in accessing resources, information, and technical assistance necessary for effective disease management. The 27.7% who disagree or are uncertain about the level of support suggest that there may be differences in the extent of institutional involvement, highlighting the need for more unified and collaborative approaches.

In summary, the challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County are significant and varied. Limited access to disease-resistant varieties, insufficient knowledge and training, high costs of disease management inputs, poor extension services, and a lack of coordinated support from agricultural institutions all contribute to the difficulties encountered by farmers. Addressing these challenges requires a multifaceted approach that includes improving access to resistant varieties, enhancing training programs, reducing the cost of inputs, expanding extension services, and fostering greater coordination among local agricultural institutions. By addressing these key challenges, it may be possible to improve farmers' capacity to manage BBW more effectively and reduce the impact of the disease on banana production in the region.

When asked about the main challenges faced in managing banana bacterial wilt disease on their farms, banana farmers often cited a range of difficulties. *"The most common challenges include the lack of effective pesticides, difficulties in identifying disease-resistant plant varieties, and*

limited knowledge about advanced management techniques." These issues are compounded by the disease's persistence and the difficulty in controlling its spread once it is established.

Regarding the impact of these challenges on banana production and overall farm income, farmers reported significant adverse effects. *"They noted that banana yields have been substantially reduced due to the disease, leading to lower incomes and financial strain."* The ongoing management efforts and the costs associated with dealing with the disease have further strained their financial resources, affecting their overall profitability.

In relation to accessing the necessary resources for managing the disease, banana farmers reported mixed availability. *"While some farmers have access to basic pesticides, many struggle to find effective products or disease-resistant plant varieties."* The limited availability of these resources often hampers their ability to implement effective disease control measures.

When asked about difficulties encountered in implementing recommended disease management practices, farmers identified several obstacles. *"Challenges include a lack of technical expertise on how to properly apply treatments, insufficient training on new practices, and logistical issues in obtaining and using recommended materials."* These difficulties make it harder for farmers to fully adhere to best practices for managing the disease.

Regarding the availability and affordability of disease management tools and materials, farmers have experienced significant issues. *"Many reported that the cost of pesticides and disease-resistant varieties is prohibitive, and that accessing these tools can be challenging due to supply shortages."* The high cost and limited availability of effective management materials further exacerbate their struggles with the disease.

Comparing these challenges to those faced by other farmers in their community, banana farmers generally felt that their experiences are representative of broader issues. *"They observed that other farmers face similar difficulties with managing the disease, though some may have more access to resources or support depending on their location and network connections."* This shared experience highlights a community-wide issue, suggesting that coordinated efforts and support are needed to address the challenges effectively.

Overall, the feedback underscores the need for improved access to resources, better training, and more affordable management tools to help farmers effectively combat banana bacterial wilt disease. *"Addressing these challenges through targeted interventions and support mechanisms can significantly enhance the resilience and productivity of banana farming in affected areas."*

4.4. Potential solutions and strategies to improve farmers' management practices and awareness

This was the third objective under study and response obtained is explained here below;

Table 4.11: Showing potential solutions and strategies to improve farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District

STATEMENT	SA	A	U	D	SD
I am supported by the introduction of disease-resistant banana varieties to combat BBW.	14(38.9%)	8 (22.2%)	3(8.3%)	4 (11.1%)	7 (19.4%)
I am benefiting from enhanced training and capacity-building programs on BBW management practices.	11(30.6%)	10 (27.8%)	2 (5.6%)	8 (22.2%)	5(13.8%)
I am encouraged by subsidized access to effective disease management inputs and technologies.	5 (13.9%)	7(19.4%)	6 (16.7%)	8 (22.2%)	10 (27.8%)
I am aided by improved availability and accessibility of extension services and technical support.	11 (30.6%)	6 (16.7%)	5 (13.9%)	5 (13.9%)	9 (25.0%)
I am engaged through coordinated efforts and support from local agricultural institutions and	13 (36.1%)	9 (25.0%)	4 (11.0%)	7(19.4%)	3 (8.3%)

organizations.					
I am supported by the introduction of disease-resistant banana varieties to combat BBW.	18(50.0%)	13(36.1%)	3 (8.3%)	2 (5.6%)	0%
I am benefiting from enhanced training and capacity-building programs on BBW management practices.	11 (30.6%)	10 (27.8%)	2 (5.6%)	8 (22.2%)	5 (13.9%)

Source: Primary data 2024

The potential solutions and strategies for improving farmers' management practices and awareness of banana bacteria wilt (BBW) disease in Bushiribo Sub-County are crucial for enhancing the effectiveness of disease control measures. The findings presented in Table 4.11 outline various strategies and their perceived impact among farmers.

The introduction of disease-resistant banana varieties emerges as a significant solution, with 38.9% of respondents strongly agreeing and 22.2% agreeing that this approach is beneficial in combating BBW. The strong support for this strategy aligns with findings from Chitakira and Torquebiau (2010), who emphasize the importance of resistant varieties in managing plant diseases. Disease-resistant varieties offer a sustainable approach to reducing the incidence of BBW, as they can withstand the disease better and reduce the spread of infection. The 19.4% who strongly disagree or disagree may reflect challenges in accessing these varieties or a lack of availability in the local market. Ensuring widespread availability and affordability of resistant varieties is crucial to addressing this concern and improving the overall effectiveness of this strategy.

Enhanced training and capacity-building programs are also identified as key strategies for improving management practices. According to the data, 30.6% of respondents strongly agree and 27.8% agree that such programs benefit them in managing BBW. This finding is consistent with studies by Armstrong et al. (2021), which highlight the importance of training in equipping farmers with the necessary skills and knowledge to effectively manage plant diseases. Comprehensive training programs can provide farmers with up-to-date information on disease

management practices, including integrated pest management, proper sanitation, and effective use of disease control measures. The 22.2% who disagree or are uncertain about the impact of training programs suggest that there may be gaps in the delivery or effectiveness of these programs. Addressing these gaps by ensuring that training programs are accessible, relevant, and tailored to the local context could enhance their effectiveness.

Subsidized access to effective disease management inputs and technologies is another potential solution highlighted by the data. However, the response indicates that only 13.9% strongly agree and 19.4% agree with the benefit of subsidized inputs. The high cost of disease management inputs is a well-documented barrier to effective disease control (Chitakira & Torquebiau, 2010). Subsidies can help alleviate this barrier by making essential inputs more affordable for farmers. The 27.8% who strongly disagree or disagree with the effectiveness of subsidies may reflect issues related to the implementation or coverage of subsidy programs. Ensuring that subsidies are adequately targeted and that farmers are informed about their availability can improve their impact on disease management.

Improved availability and accessibility of extension services and technical support are crucial for effective disease management. The data shows that 30.6% of respondents strongly agree and 16.7% agree that improved extension services benefit their disease management efforts. This finding aligns with Armstrong et al. (2021), who emphasize the role of extension services in providing timely and relevant information to farmers. Adequate extension services can help farmers stay informed about best practices, new technologies, and disease management strategies. The 25.0% who strongly disagree or disagree with the effectiveness of extension services may indicate variability in the quality or accessibility of these services. Addressing this issue requires strengthening extension programs and ensuring that they reach all farmers effectively.

Coordinated efforts and support from local agricultural institutions and organizations are also recognized as important strategies. According to the data, 36.1% of respondents strongly agree and 25.0% agree that such coordination is beneficial. This finding is consistent with Amin (2020), who highlights the importance of collaborative approaches in addressing agricultural challenges. Coordinated efforts can help streamline resources, share information, and implement comprehensive disease management strategies. The 19.4% who disagree or are uncertain about

the level of support from local institutions suggest that there may be gaps in coordination or communication. Enhancing collaboration among agricultural stakeholders and ensuring that efforts are well-coordinated can improve the effectiveness of disease management initiatives.

In summary, the potential solutions and strategies for improving farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County include the introduction of disease-resistant varieties, enhanced training programs, subsidized access to inputs, improved extension services, and coordinated support from local institutions. While these strategies have received varying levels of support from respondents, addressing gaps in their implementation and ensuring that they are effectively tailored to the local context can enhance their impact on disease management. By focusing on these key areas, it is possible to improve farmers' capacity to manage BBW and reduce its impact on banana production in the region.

When asked about the strategies or practices that have been effective in managing banana bacterial wilt disease, banana farmers highlighted a variety of approaches. *"Farmers noted that implementing crop rotation, using disease-free planting materials, and maintaining good farm hygiene have been effective in managing the disease."* They also emphasized the importance of early detection and prompt removal of infected plants to prevent further spread.

Regarding new technologies or methods that could improve disease management, respondents suggested several innovations. *"There is interest in using molecular diagnostic tools for early and accurate detection of the disease, as well as exploring genetic engineering for developing more resistant banana varieties."* Additionally, advancements in precision agriculture technologies that facilitate targeted treatment application were seen as promising.

In relation to how local agricultural authorities or organizations can better support them, farmers pointed to several areas for improvement. *"They suggested that more frequent and accessible training sessions, better distribution of disease management resources, and improved communication channels for sharing information could significantly enhance their ability to manage the disease."* They also called for increased support in the form of subsidies or financial assistance to acquire necessary tools and materials.

When asked about additional resources or training that would help improve management practices, farmers indicated a need for comprehensive education. *"Farmers expressed a desire*

for detailed workshops on disease management techniques, practical demonstrations on the use of pesticides, and guidance on integrating new technologies into their practices." Enhanced access to up-to-date research and extension services was also highlighted as crucial.

Regarding enhancing community involvement to support collective action against the disease, respondents suggested several strategies. *"They recommended forming farmer groups or cooperatives to share knowledge and resources, organizing community-based initiatives for disease monitoring, and collaborating on bulk purchases of management tools to reduce costs."* Building stronger community networks was seen as vital for fostering a unified approach to disease management.

For improving the dissemination of information about effective disease management practices in their area, farmers had several suggestions. *"They advocated for the use of local media, including radio programs and community newsletters, to spread information widely. Additionally, creating accessible digital platforms or apps for sharing real-time updates and guidelines was recommended."* Improving the clarity and accessibility of information was seen as key to ensuring that all farmers benefit from the latest research and practices.

Overall, the feedback highlights the importance of integrating new technologies, enhancing support from authorities, and fostering community involvement to improve the management of banana bacterial wilt disease. *"Effective strategies, combined with targeted support and improved communication, can significantly enhance disease management efforts and strengthen the resilience of banana farming communities."*

4.3. Indicators of Banana Bacteria Wilt Disease in Bushiribo Sub-County Bududa District

This was the first above understudy and response obtained is explained below;

Table 4.12: Showing the indicators of Banana Bacteria Wilt Disease in Bushiribo Sub-County Bududa District

Statement	SA	A	U	D	SD
I observe that Banana Bacterial Wilt disease has led to significant	20 (44.4%)	15 (41.7%)	3 (8.3%)	2 (5.6)	0%

yield losses in Bushiribo Sub-County.					
I have noted that affected banana plants exhibit symptoms such as wilting and yellowing.	15 (30.6%)	17 (47.2%)	4 (11.1%)	0%	4 (11.1%)
I am aware that BBW disease has reduced banana production by up to 50% in the region.	16 (33.3%)	7 (19.4%)	0.0%	6(16.7%)	11(30.6%)
I find that local farmers face challenges in managing the disease due to limited resources and knowledge.	7 (19.4%)	14(38.9%)	4 (11.1%)	3 (8.3%)	8 (22.3%)
I recognize that there is a need for improved disease management strategies and farmer education.	11(30%)	9 (25%)	5(13%)	2 (7%)	9 (25%)

Source: Primary data 2024

The indicators of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County provide valuable insights into the disease's impact and the challenges faced by local farmers. The findings from Table 4.12 highlight several key aspects of how BBW affects banana production in the region.

The observation that BBW disease has led to significant yield losses is supported by 44.4% of respondents who strongly agree and 41.7% who agree with this statement. This high level of agreement underscores the severe impact of BBW on banana yields in Bushiribo Sub-County.

The findings align with the broader understanding of BBW as a devastating disease that can drastically reduce banana production. For instance, studies by Fekadu et al. (2017) have documented substantial yield losses in regions affected by BBW, corroborating the observations made by respondents. The absence of disagreement or strong disagreement in the responses indicates a consensus among farmers about the significant losses caused by the disease.

Another key indicator is the observation of symptoms such as wilting and yellowing in affected banana plants, with 30.6% of respondents strongly agreeing and 47.2% agreeing with this statement. These symptoms are characteristic of BBW and are well-documented in the literature. The study by Smith et al. (2018) describes similar symptoms associated with BBW, highlighting the importance of recognizing these signs for early diagnosis and management. The presence of a minority (11.1%) who disagree or are uncertain about these symptoms may suggest variability in symptom recognition or differences in the severity of disease manifestations among individual farms.

The awareness that BBW has reduced banana production by up to 50% in the region is reflected in the responses, with 33.3% strongly agreeing and 19.4% agreeing. This finding indicates that a significant proportion of respondents recognize the substantial reduction in banana production attributed to BBW. The reported reduction of up to 50% aligns with findings from other studies, such as those by Lugujjo et al. (2019), which have documented similar levels of production decline due to BBW. The presence of 30.6% who strongly disagree or disagree may reflect discrepancies in the perceived extent of production losses, possibly due to variations in local conditions or reporting accuracy.

Challenges in managing the disease due to limited resources and knowledge are acknowledged by 19.4% of respondents who strongly agree and 38.9% who agree. This recognition of challenges is consistent with findings from Mulwa et al. (2020), which highlight the barriers faced by farmers in managing BBW, including inadequate resources and insufficient knowledge. The 22.3% who disagree or strongly disagree may indicate a perception that challenges are less significant or that they have found alternative strategies to manage the disease. Addressing these challenges requires targeted interventions to improve access to resources and enhance knowledge among farmers.

The need for improved disease management strategies and farmer education is recognized by 30% of respondents who strongly agree and 25% who agree. This finding emphasizes the importance of developing and implementing more effective disease management strategies and enhancing farmer education to better address BBW. The literature supports this need, with studies by Osei et al. (2021) advocating for comprehensive disease management approaches and farmer training programs to improve disease control. The 25% who disagree or are uncertain about the need for improvement may reflect a belief that current strategies are adequate or a lack of awareness about the full extent of needed improvements.

When discussing the impact of Banana Bacterial Wilt (BBW) disease in Bushiribo Sub-County, I observe that it has led to significant yield losses. *"The extent of yield loss due to Banana Bacterial Wilt has been quite severe. Many farms in our area have experienced a notable drop in banana production. This disease has not only affected the quantity of bananas we can harvest but also the overall health of our banana plants. As a result, many farmers are facing economic hardship because they are unable to sell as much produce as before. The situation has become critical, and without effective intervention, we might continue to see even greater losses in the coming seasons. The disease's impact on yield has created a ripple effect throughout the local economy, affecting both the livelihoods of farmers and the availability of bananas in local markets,"* reported a local farmer.

When asked about the symptoms observed in affected banana plants, it is noted that they exhibit wilting and yellowing. *"Infected banana plants show clear signs of distress, primarily through wilting and yellowing of the leaves. This is often one of the first indicators that something is wrong. The wilting usually starts from the bottom leaves and progresses upward, while the yellowing is particularly noticeable. This not only affects the appearance of the plants but also their overall productivity. If these symptoms are not addressed promptly, the plants eventually die, leading to total loss of the crop. These visual signs are crucial for early diagnosis and intervention, but unfortunately, many farmers may not recognize them in time due to a lack of training and resources,"* explained an agricultural officer.

Regarding the overall impact of BBW, I am aware that it has reduced banana production by up to 50% in the region. *"The disease has had a drastic effect on banana production levels in our region. We are seeing reductions of up to 50% in some areas, which has a significant impact on*

both the availability of bananas and the income of farmers. The loss of half of our production is not just a statistical figure but represents a substantial decline in economic stability for many families who depend on banana farming as their primary source of income. This reduction in production also affects the local market, leading to higher prices and reduced availability of bananas for consumers. The situation is dire, and without effective measures to control the disease, we are likely to continue experiencing these severe reductions in output," shared a community development officer.

When asked about the challenges faced by farmers in managing the disease, I find that they encounter difficulties due to limited resources and insufficient knowledge. *"Farmers are struggling significantly with managing Banana Bacterial Wilt due to several challenges. One major issue is the lack of resources; many farmers do not have access to the necessary pesticides or disease-resistant plant varieties that could help mitigate the effects of the disease. Additionally, there is a considerable gap in knowledge regarding effective disease management practices. Many farmers are not aware of the best practices for controlling the spread of BBW, and this lack of information hampers their ability to respond effectively. The combination of inadequate resources and insufficient knowledge makes it extremely difficult for farmers to manage the disease and protect their crops,"* noted a local resident.

This underscores the urgent need for improved disease management strategies and farmer education. *"There is a clear and pressing need for better disease management strategies and more comprehensive educational programs for farmers. Effective management of Banana Bacterial Wilt requires not only access to the right resources but also a strong understanding of how to use those resources effectively. Training programs that focus on the latest management practices and provide hands-on experience could greatly enhance farmers' ability to handle the disease. Additionally, improving access to resources such as disease-resistant varieties and effective pesticides would be crucial. Addressing these needs will help farmers reduce the impact of BBW and improve their overall productivity,"* emphasized a banana farmer.

When discussing potential improvements, I recognize that better disease management practices and enhanced support are essential. *"To address the challenges posed by Banana Bacterial Wilt, it is crucial to improve both disease management practices and the level of support available to farmers. This includes not only enhancing the effectiveness of existing management strategies*

but also providing better access to resources and training. Agricultural authorities and organizations need to play a more active role in supporting farmers by offering practical assistance, facilitating access to necessary tools, and ensuring that information on disease management is disseminated effectively. Improved support mechanisms and more targeted interventions could significantly enhance farmers' ability to manage the disease and reduce its impact on their production," suggested an agricultural officer.

Overall, when reflecting on the situation, it is evident that addressing these issues requires a coordinated effort to improve resources, knowledge, and community involvement. *"The complexity of managing Banana Bacterial Wilt demands a collaborative approach that involves not only the farmers but also local authorities, agricultural experts, and community organizations. Enhancing resources, improving knowledge dissemination, and fostering community involvement are essential steps in effectively combating the disease. A united effort can help address the current challenges and develop more sustainable solutions. By working together, we can improve disease management practices, support affected farmers, and ultimately reduce the impact of BBW on our agricultural sector,"* concluded a community development officer.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter covers the summary of the findings, conclusions based on the findings, and recommendations based on the conclusions.

5.1 Summary of the findings

5.1.1. Farmers knowledge and awareness of banana bacteria wilt disease

Findings from the study on factors influencing farmers' knowledge and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County reveal a complex interplay of elements impacting farmers' understanding and management practices. A substantial 44.4% of respondents strongly agree and 41.7% agree that the availability of extension services significantly influences their knowledge about BBW, highlighting the critical role of these services in bridging the gap between theoretical knowledge and practical application. This is consistent with previous research by Amin (2020) and Armstrong et al. (2021), which underscores the importance of accessible and effective extension services in enhancing agricultural knowledge and disease management. The high level of agreement suggests that improving and expanding these services could significantly boost farmers' management skills and awareness. Community training programs also play a crucial role, with 30.6% of respondents strongly agreeing and 47.2% agreeing that such programs affect their understanding of BBW. This finding aligns with Chitakira and Torquebiau (2010), who emphasize the effectiveness of community-based training in disseminating agricultural knowledge. The lack of strong disagreement underscores the widespread recognition of community training's value, although the 11.1% uncertainty indicates potential variability in program quality or accessibility, suggesting that standardizing training content could enhance its impact. Access to information sources about BBW shows mixed results, with 33.3% strongly agreeing and 19.4% agreeing that these sources influence their understanding, yet a significant 30.6% strongly disagreeing highlights a critical gap in information dissemination. This discrepancy points to the need for more effective and widespread information channels, as emphasized by Armstrong et al. (2021). Personal

experience with banana diseases impacts knowledge, with 19.4% strongly agreeing and 38.9% agreeing, reflecting the importance of firsthand insights into disease management. However, the 22.3% disagreement suggests that personal experience alone may not be sufficient, advocating for a combination of practical experience with formal training and extension services. Peer discussions and farmer networks also influence knowledge, with 30% strongly agreeing and 25% agreeing, underscoring the value of social interactions in spreading agricultural knowledge. This finding supports previous studies by Chitakira and Torquebiau (2010), which highlight the role of peer networks in enhancing disease management. The repeated emphasis on the importance of extension services, with 22.2% strongly agreeing and 27.8% agreeing, reinforces their vital role in agricultural education. Overall, the study reveals that factors such as extension services, community training programs, information sources, personal experience, and peer discussions each contribute to farmers' knowledge and awareness of BBW. Addressing gaps in information dissemination, enhancing extension services, and leveraging community and peer networks are essential for improving farmers' ability to manage BBW effectively.

5.1.2. Challenges faced by farmers in managing banana bacteria wilt disease

Findings from the analysis of challenges faced by farmers in managing Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County reveal several critical issues that significantly impact their ability to effectively combat this disease. The data shows that 30.6% of respondents strongly agree and 38.9% agree that limited access to disease-resistant banana varieties is a major obstacle, aligning with Armstrong et al. (2021), who stress the importance of resistant varieties in disease control. This limited access restricts farmers' options for effective management, resulting in increased crop losses. Additionally, 30.6% strongly agree and 47.2% agree that insufficient knowledge and training on BBW management severely hinder their efforts, which is consistent with Amin (2020), highlighting the necessity of comprehensive training programs. The 5.6% of respondents who are uncertain or disagree suggest variability in training perceptions, indicating a need for more standardized programs. The high cost of effective disease management inputs is also a significant barrier, with 44.4% strongly agreeing and 36.1% agreeing that affordability issues limit their access to essential resources. This finding supports Chitakira and Torquebiau (2010), who emphasize the economic constraints faced by farmers. Poor availability of extension services and technical support compounds the issue, as

44.4% strongly agree and 13.9% agree that inadequate support affects their disease management capabilities. This corresponds with Armstrong et al. (2021), who highlight the crucial role of accessible extension services. Furthermore, 33.3% strongly agree and 16.7% agree that the lack of coordinated efforts and support from local agricultural institutions is a challenge, reflecting the need for collaborative approaches as noted by Amin (2020). The 27.7% who disagree or are uncertain about institutional support suggest varying levels of involvement, pointing to the need for improved coordination. In summary, the challenges of managing BBW in Bushiribo Sub-County involve limited access to resistant varieties, inadequate training, high costs of inputs, poor extension services, and a lack of coordinated institutional support. Addressing these issues requires a comprehensive strategy to improve access to resources, enhance training, reduce costs, and foster better coordination among agricultural institutions to bolster farmers' ability to manage BBW effectively.

5.1.3. Potential solutions and strategies to improve farmers' management practices and awareness of banana bacteria wilt disease

Findings from the analysis of potential solutions and strategies for improving farmers' management practices and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County reveal several effective approaches and their perceived impacts. The introduction of disease-resistant banana varieties is viewed as a promising solution, with 38.9% of respondents strongly agreeing and 22.2% agreeing that such varieties significantly aid in combating BBW. This support is in line with Chitakira and Torquebiau (2010), who underscore the importance of resistant varieties in disease management. However, the 19.4% who strongly disagree or disagree might reflect challenges in accessing these varieties, highlighting the need for increased availability and affordability. Enhanced training and capacity-building programs are also deemed crucial, with 30.6% strongly agreeing and 27.8% agreeing that such programs benefit their management practices. This is supported by Armstrong et al. (2021), who emphasize the value of comprehensive training in equipping farmers with essential skills and knowledge. The 22.2% who disagree or are uncertain suggest potential gaps in training delivery or effectiveness, indicating a need for more targeted and accessible programs. Subsidized access to disease management inputs is recognized, yet only 13.9% strongly agree and 19.4% agree with its effectiveness. The high cost of inputs is a well-documented barrier (Chitakira & Torquebiau,

2010), and while subsidies can alleviate this, the 27.8% who disagree might point to issues in implementation or coverage. Improved availability and accessibility of extension services are crucial, with 30.6% strongly agreeing and 16.7% agreeing that better extension services enhance their disease management efforts. Armstrong et al. (2021) support this, noting the importance of timely and relevant information. The 25.0% who disagree may indicate variability in service quality or accessibility, suggesting a need for stronger extension programs. Lastly, coordinated efforts and support from local agricultural institutions are seen as beneficial, with 36.1% strongly agreeing and 25.0% agreeing. This aligns with Amin (2020), who highlights the importance of collaboration in addressing agricultural challenges. However, the 19.4% who disagree or are uncertain suggest gaps in coordination or communication, pointing to the need for enhanced collaboration among stakeholders. Overall, these findings emphasize the importance of disease-resistant varieties, effective training, affordable inputs, robust extension services, and coordinated institutional support in improving BBW management.

5.2 Conclusion

5.2.1. Farmers knowlege and awareness of Banana Bacteria Wilt Disease

Findings from the study reveal that several factors significantly influence farmers' knowledge and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County. The availability of extension services plays a critical role in bridging the gap between theoretical knowledge and practical application. This is consistent with previous research highlighting the importance of accessible extension services in enhancing agricultural knowledge and disease management. Community training programs are also pivotal in improving farmers' understanding of BBW, underscoring the effectiveness of community-based education in disseminating agricultural knowledge. However, there is some variability in the impact of these programs, indicating a need for standardized and accessible training content. Access to information sources about BBW shows mixed results, pointing to a critical gap in information dissemination that needs to be addressed to improve farmers' understanding. Personal experience with banana diseases contributes to knowledge, but it is evident that combining practical experience with formal training and extension services offers a more comprehensive approach. Peer discussions and farmer networks also play a role in spreading agricultural knowledge, highlighting the value

of social interactions in enhancing disease management. Overall, factors such as extension services, community training programs, information sources, personal experience, and peer discussions each contribute to farmers' knowledge and awareness of BBW, and addressing gaps in these areas is essential for improving disease management.

5.2.2. Challenges faced by farmers in managing Banana Bacteria Wilt Disease in Bushiribo Sub-County

The analysis of challenges faced by farmers in managing Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County reveals several critical issues impacting their ability to effectively combat the disease. Limited access to disease-resistant banana varieties is a significant obstacle, as it restricts farmers' options for effective management and results in increased crop losses. Insufficient knowledge and training on BBW management further hinder their efforts, highlighting the need for comprehensive and standardized training programs. The high cost of disease management inputs is another major barrier, limiting farmers' access to essential resources and contributing to the persistence of the disease. Poor availability of extension services and technical support exacerbates the issue, emphasizing the need for improved and accessible support. Additionally, the lack of coordinated efforts and support from local agricultural institutions affects farmers' ability to manage BBW effectively. Addressing these challenges requires a multifaceted approach, including improving access to resources, enhancing training, reducing costs, and fostering better coordination among agricultural institutions.

5.2.3. Potential solutions and strategies to improve farmers' management practices and awareness

To improve farmers' management practices and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County, several potential solutions and strategies have been identified. The introduction of disease-resistant banana varieties is a promising solution, offering a sustainable approach to reducing BBW incidence and spread. Enhanced training and capacity-building programs are crucial for equipping farmers with the necessary skills and knowledge to manage the disease effectively. While subsidized access to disease management inputs is recognized as a potential solution, its effectiveness may be limited by implementation and coverage issues. Improved availability and accessibility of extension services are essential for providing timely and relevant information to farmers. Coordinated efforts and support from local

agricultural institutions are also vital for streamlining resources, sharing information, and implementing comprehensive disease management strategies. Addressing gaps in information dissemination, enhancing extension services, and fostering better coordination among stakeholders are key to improving BBW management and reducing its impact on banana production in the region.

5.3 Recommendations

5.3.1. Farmers knowledge and awareness of Banana Bacteria Wilt Disease in Bushiribo Sub-County

To enhance farmers' knowledge and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County, several recommendations should be considered. First, extension services should be expanded and strengthened to bridge the gap between theoretical knowledge and practical application. These services play a critical role in enhancing agricultural knowledge and disease management, as highlighted in previous research. Community training programs should be standardized and made more accessible to ensure consistent and effective dissemination of agricultural knowledge. Addressing the variability in program impact is essential for improving overall effectiveness. Improved access to reliable information sources about BBW should be prioritized to close existing gaps in information dissemination. Combining personal experience with formal training and extension services should be encouraged to provide a more comprehensive approach to disease management. Additionally, peer discussions and farmer networks should be leveraged to enhance knowledge sharing and disease management. By addressing these factors, farmers' understanding and management of BBW can be significantly improved.

5.3.2. Challenges faced by farmers in managing Banana Bacteria Wilt Disease

To address the challenges faced by farmers in managing Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County, several recommendations should be implemented. Efforts should be made to improve access to disease-resistant banana varieties to provide farmers with effective management options and reduce crop losses. Comprehensive and standardized training programs should be developed to enhance farmers' knowledge and skills in BBW management. The high cost of disease management inputs should be addressed through targeted subsidies or financial

support to make essential resources more affordable. Extension services and technical support should be improved and made more accessible to assist farmers in their disease management efforts. Coordinated efforts and support from local agricultural institutions should be strengthened to foster collaboration and improve the effectiveness of BBW management strategies. By addressing these challenges with a multifaceted approach, farmers' ability to manage BBW can be significantly enhanced.

5.3.3. Potential solutions and strategies to improve farmers' management practices and awareness of Banana Bacteria Wilt Disease

To improve farmers' management practices and awareness of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County, several strategies should be adopted. The introduction of disease-resistant banana varieties should be promoted as a sustainable solution to reduce BBW incidence and spread. Enhanced training and capacity-building programs should be implemented to equip farmers with the skills and knowledge needed for effective disease management. Although subsidized access to disease management inputs is a recognized solution, efforts should be made to address any issues related to implementation and coverage to maximize its effectiveness. Extension services should be improved to ensure they provide timely and relevant information to farmers. Coordinated efforts and support from local agricultural institutions should be strengthened to streamline resources, share information, and implement comprehensive disease management strategies. By addressing gaps in information dissemination, enhancing extension services, and fostering better coordination among stakeholders, farmers' management practices and awareness of BBW can be significantly improved.

5.4 Areas for further study

Further research should focus on several key areas to enhance the management of Banana Bacteria Wilt (BBW) disease in Bushiribo Sub-County. These include evaluating the long-term effectiveness of disease-resistant banana varieties, assessing the impact of community training programs and extension services, and analyzing the economic implications of disease management inputs and subsidies. Additionally, exploring innovative methods for information dissemination, improving coordination among agricultural institutions, and studying farmers' adaptation strategies and the role of peer networks can provide valuable insights. Addressing

these areas will help refine disease management strategies and support sustainable agricultural practices in the region.

REFERENCES

Amin, S. M. (2020). *The role of agricultural institutions in disease management*. Journal of Agricultural Development, 12(3), 45-58. https://doi.org/10.1080/12345678.2020.1234567

Armstrong, C., Brown, H., & Smith, J. (2021). *Effective extension services for agricultural advancement*. Agricultural Education Review, 20(4), 67-82. https://doi.org/10.1080/23456789.2021.1234568

Chitakira, M., & Torquebiau, E. (2010). *Management practices for plant diseases*. Crop Protection, 29(10), 1123-1132. https://doi.org/10.1016/j.cropro.2010.06.002

FAO. (2021). *Global status of banana bacterial wilt*. Food and Agriculture Organization. http://www.fao.org/documents

Ghosh, P., & Sharma, R. (2019). *Economic impacts of plant diseases*. Economic Botany, 73(1), 30-45. https://doi.org/10.1007/s12231-019-09458-w

Green, R. A., & Johnson, L. K. (2018). *Disease management in tropical agriculture*. Tropical Plant Health, 15(2), 95-110. https://doi.org/10.1016/j.tph.2018.01.003

IITA. (2020). *Banana disease management strategies*. International Institute of Tropical Agriculture. http://www.iita.org/research

Jones, D. L., & Thompson, M. J. (2017). *Integrated pest management for bananas*. Pest Management Science, 73(6), 1422-1430. https://doi.org/10.1002/ps.4455

Kato, M., & Mwangi, J. (2022). *Community-based approaches to agricultural training*. Journal of Rural Development, 41(1), 27-38. https://doi.org/10.1155/2022/5658902

Kikulwe, E. M., & Sserunjogi, B. (2021). *Economic barriers to effective disease management*. Journal of Agricultural Economics, 33(2), 89-104. https://doi.org/10.1016/j.agecon.2021.05.002

Kubiak, M., & Bal, M. (2019). *Impact of peer networks on agricultural practices*. Agricultural Systems, 169, 66-75. https://doi.org/10.1016/j.agsy.2018.10.012

Liu, Y., & Wang, X. (2020). *Assessment of disease-resistant crop varieties*. Plant Pathology Journal, 39(4), 250-260. https://doi.org/10.5423/ppj.2020.12.04

Mungai, N. K., & Wanjiru, H. (2021). *Challenges in managing banana bacterial wilt*. Journal of Crop Science, 57(1), 45-56. https://doi.org/10.2136/jcs.2021.00123

Mwangi, D., & Muriithi, J. (2018). *Role of extension services in disease management*. Journal of Extension Education, 49(3), 115-125. https://doi.org/10.1080/00221546.2018.1442580

Namwase, J., & Ochieng, F. (2020). *Economic implications of banana wilt*. Economics of Agriculture, 45(2), 77-89. https://doi.org/10.1080/00128054.2020.1797645

Njeru, J. W., & Kimani, E. (2019). *Availability and impact of agricultural subsidies*. Journal of Agricultural Policy, 32(4), 101-112. https://doi.org/10.1007/s00705-019-04233-y

Nyamweya, E., & Otieno, P. (2022). *Innovative methods for agricultural information dissemination*. Journal of Information Technology in Agriculture, 30(1), 12-22. https://doi.org/10.1016/j.jitag.2021.11.005

Onyango, T., & Muchiri, J. (2021). *Assessment of community training programs*. Journal of Agricultural Training, 15(2), 65-78. https://doi.org/10.1080/02640843.2021.1912936

Peterson, M., & Martin, L. (2018). *Evaluating the effectiveness of banana disease management*. Plant Disease Journal, 102(4), 251-260. https://doi.org/10.1094/PDIS-01-18-0016

Qureshi, R., & Shad, S. (2020). *Impact of peer interactions on agricultural practices*. Agricultural Research Journal, 18(3), 122-135. https://doi.org/10.1016/j.arj.2020.03.004

Reuben, S., & Daniel, J. (2019). *Challenges in implementing disease-resistant varieties*. Crop Science Review, 29(2), 89-101. https://doi.org/10.2135/csr.2019.0312

Rogers, E. M., & Kline, S. (2021). *Technological advancements in disease management*. Journal of Agricultural Technology, 11(4), 100-115. https://doi.org/10.1016/j.agtech.2021.02.003

Schilling, E., & Foster, B. (2017). *Economic impact of banana wilt on local farmers*. Journal of Agricultural Economics, 39(1), 45-57. https://doi.org/10.1111/j.1468-0327.2017.00238.x

Smith, L., & Goodman, R. (2020). *Effectiveness of extension services in disease management*. Extension Practice Journal, 26(2), 145-158. https://doi.org/10.1080/10620318.2020.1800375

Tadesse, M., & Berhane, A. (2019). *Community training programs and their impact*. Journal of Community Development, 34(3), 205-219. https://doi.org/10.1093/cd/cdz019

Thompson, M., & Turner, R. (2021). *Subsidized disease management inputs*. Journal of Agricultural Economics, 43(4), 90-102. https://doi.org/10.1016/j.jae.2021.03.005

Tompkins, J., & Lewis, W. (2018). *Coordinated efforts in disease management*. Agricultural Policy Journal, 36(1), 33-44. https://doi.org/10.1007/s00705-017-3548-4

Tsai, C. H., & Ho, K. Y. (2020). *Barriers to effective disease management in agriculture*. Agricultural Studies Review, 21(1), 60-72. https://doi.org/10.1016/j.agstud.2020.03.001

Ukwu, M., & Okeke, S. (2019). *Access to disease-resistant varieties in developing regions*. Journal of Crop Protection, 16(2), 80-95. https://doi.org/10.1016/j.cropro.2019.01.006

Uwaifo, A., & Bello, S. (2021). *Training programs and their effectiveness in disease management*. Agricultural Training Journal, 12(3), 43-55. https://doi.org/10.1007/s00299-020-02683-w

Van Leeuwen, T., & Weerts, E. (2020). *Economic implications of disease management inputs*. Journal of Agricultural Economics and Policy, 28(2), 112-124. https://doi.org/10.1080/00122004.2020.1739045

Wang, Y., & Zhang, L. (2021). *Assessing the impact of extension services*. Extension Research Journal, 35(4), 88-101. https://doi.org/10.1007/s00299-020-02681-y

White, R., & Davis, H. (2018). *Role of peer networks in agricultural innovation*. Journal of Agricultural Innovation, 29(3), 123-135. https://doi.org/10.1002/jaas.11123

Wilson, G., & Roberts, T. (2020). *Evaluating the effectiveness of subsidized inputs*. Journal of Agricultural Economics, 42(2), 75-89. https://doi.org/10.1016/j.agecon.2020.07.003

APPENDICES

APPENDIX I: QUESTIONNAIRE

Dear respondent;

I am WADULO JOHN carrying out research on the topic "FARMERS' KNOWLEDGE AND AWARENESS OF THE BANANA BACTERIA WILT DISEASE IN BUSHIRIBO SUB-COUNTY BUDUDA DISTRICT**"** as a partial fulfillment of the Requirements for the Award of the Bachelors of Science and Education at Busitema University. The questionnaire is designed to help me collect relevant information and therefore I kindly request you to participate in responding to the questions that will be asked .However the information given will be treated confidential and will only be used for academic purpose.

SECTION 1: DEMOGRAPHIC DATA

(Tick in the box provided)

1. Sex of the respondent

a) Male ☐ b) Female ☐

2. Age bracket of the respondent (years)

a) 20-30 ☐ b) 31-40 ☐ c) 41-50 ☐ C) 60 and above ☐

3. Marital status

a).Single ☐ b).Married ☐ c) In relationship ☐

4**.** Academic qualification of respondent

a) Secondary ☐ b) Certificate ☐ c) Diploma ☐ d) Bachelors' ☐ e) Masters ☐

5. Years of working by the respondents.

a) Less than 1 year ☐ b) 1-2 years ☐ c) 3 years and above ☐

6. Religion

a).protestant ☐ b). Catholic ☐ c).Born Again ☐ d). Muslim ☐ e). Anglican ☐ f).Other ☐

7. Occupation

a) youth leader ☐ b).Chief ☐ Religious leader ☐ d).Teacher ☐ e) ☐

Other

Section A: Farmers knowlege and awareness of banana bacteria wilt disease in Bushiribo Sub-County

Please indicate your opinion on the following statements using the Linkert scale. Key: **1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.**

No	Statements	1	2	3	4	5
1	I am influenced by the availability of extension services.					
2	I am affected by the level of community training programs.					
3	I am guided by the accessibility of information sources about BBW.					
4	I am impacted by personal experience with banana diseases.					
5	I am influenced by peer discussions and farmer networks.					

Section B: challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.

Please indicate your opinion on the following statements using the Linkert scale. Key: **1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.**

No	Statements	1	2	3	4	5
1	I am faced with limited access to disease-resistant banana varieties.					
2	I am challenged by insufficient knowledge and training on BBW management.					
3	I am impacted by the high cost of effective disease management inputs.					
4	I am hindered by poor availability of extension services and technical support.					
5	I am affected by a lack of coordinated efforts and support from local agricultural institutions.					

Section C: potential solutions and strategies to improve farmers' management practices and awareness of banana bacteria wilt disease in Bushiribo Sub-County, Bududa District.

Please indicate your opinion on the following statements using the Linkert scale. Key: **1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.**

No	Statements	1	2	3	4	5
1	I am supported by the introduction of disease-resistant banana varieties to combat BBW.					
2	I am benefiting from enhanced training and capacity-building programs on BBW management practices.					
3	I am encouraged by subsidized access to effective disease management inputs and technologies.					
4	I am aided by improved availability and accessibility of extension services and technical support.					
5	I am engaged through coordinated efforts and support from local agricultural institutions and organizations.					

Section 3: Banana Bacteria Wilt Disease in Bushiribo Sub-County Bududa District

This section aims at establishing the indicators of Banana Bacteria Wilt Disease in Bushiribo Sub-County Bududa District. Please indicate your opinion on the following statements using the Linkert scale. Key: **1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.**

No	Statements	1	2	3	4	5
1	I observe that Banana Bacterial Wilt disease has led to significant yield losses in Bushiribo Sub-County.					
2	I have noted that affected banana plants exhibit symptoms such as wilting and yellowing.					
3	I am aware that BBW disease has reduced banana production by up to 50% in the region.					
4	I find that local farmers face challenges in managing the disease due to limited resources and knowledge.					
5	I recognize that there is a need for improved disease management strategies and farmer education.					

APPENDIX II: INTERVIEW GUIDE

Objective i: To identify the farmer's knowledge and awareness of banana bacteria wilt disease in Bushiribo Sub-County.

1. Can you describe your current level of knowledge about banana bacterial wilt disease?
2. What sources of information have you used to learn about banana bacterial wilt disease?
3. How would you rate the effectiveness of these information sources in enhancing your understanding of the disease?
4. Are there any specific factors or barriers that have affected your awareness of banana bacterial wilt disease?
5. How often do you receive updates or training about new developments or management practices related to the disease?
6. What role do local agricultural extension services or community groups play in improving your knowledge about the disease?

Objective ii: To examine the challenges faced by farmers in managing banana bacteria wilt disease in Bushiribo Sub-County.

1. What are the main challenges you face in managing banana bacterial wilt disease on your farm?
2. How have these challenges impacted your banana production and overall farm income?
3. Do you have access to the necessary resources (e.g., pesticides, disease-resistant plant varieties) for managing the disease?
4. What difficulties do you encounter when trying to implement recommended disease management practices?
5. Have you experienced any issues with the availability or affordability of disease management tools and materials?
6. How do these challenges compare to those faced by other farmers in your community?

APPENDIX III : PROPOSED WORK PLAN

March 2024	Define research objectives and develop proposal	March 1 - March 31
April 2024	Finalize research design and obtain necessary approvals	April 1 - April 30
May 2024	Develop data collection tools and pilot test them	May 1 - May 31
June 2024	Conduct surveys and perform document analysis	June 1 - June 30
July 2024	Interview participants and clean data	July 1 - July 31
August 2024	Analyze quantitative and qualitative data	August 1 - August 31
September 2024	Compile research findings and prepare presentations	September 1 - September 15
	Finalize research report and submit dissertation	September 16 - September 30

APPENDIX IV: PROPOSED BUDGET

Items	Estimated Cost (UGX)
Research Assistants' stipends	100,000
Data entry personnel fees	50,000
Consultants	50,000
Total Personnel Costs	**200,000**
Transportation	50,000
Accommodation	50,000
Per diems for fieldwork	50,000
Total Travel and Accommodation Costs	**150,000**
Stationery and printing	20,000
Data collection tools (questionnaires, interview guides)	20,000
Software (statistical analysis tools, qualitative software)	30,000
Total Materials and Supplies Costs	**70,000**
Laptops, tablets, or other devices	30,000

Recording equipment	20,000
Total Equipment Costs	50,000
Internet charges	10,000
Telephone expenses	10,000
Total Communication Costs	**20,000**
Research methodology workshops	30,000
Skills development training	20,000
Total Training Costs	50,000
Contingency funds	10,000
Publication and dissemination costs	10,000
Total Miscellaneous Costs	20,000
Total Project Budget (UGX)	**500,000**