The Impact of Integrated Pest Management Practices in Controlling Twig Borer in Coffee Production in Kaboijana village kitoba subcounty in Hoima district

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A research report submitted to Faculty of Technology for Rural Transformation in partial fulfillment of the requirements for award of Bachelor of Science in Sustainable Agriculture of African Rural University

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Declaration

I, Musiimenta Mackline, hereby declare that the research study titled "*The Impact of Integrated Pest Management Practices on controlling twig borer in coffee production*" is my original work and has never been submitted to any institution for any academic award.

Sign ....Mllbckltte.........

Date......16/06/2025........

Approval

This research report was derived from the research work that was carried out under our supervision and is ready for submission to the examination committee.

Signed..................................

Mr. Kusiima Jackson (Faculty supervisor)

Date. 16/6/2025

Signed..................................

Mr. Kansiime Bosco (Field supervisor)

Date. 30/oct/2025

Dedication

This research is dedicated to my family and friends, whose unwavering support and encouragement have been a constant source of inspiration, and to my supervisor Mr. kusiima Jackson for academic support given to me and the community members who were there to work with me.

Musiimenta Mackline

Acknowledgement

First and foremost, I extend my heartfelt thanks to the coffee farmers who participated in this study. Their willingness to share their experiences, insights, and perspectives led to the success of this research. Without their cooperation and openness, this study would not be possible.

Furthermore, I acknowledge the support and guidance of my faculty supervisor, Mr. Kusiima Jackson throughout the duration of this project. His expertise, feedback, and encouragement helped to shape the research methodology, analysis, and interpretation of results.

I also wish to express my sincere appreciation to my field supervisor Mr. Kansiime Bosco for his invaluable assistance and practical guidance during the data collection process. His contributions were vital to the successful execution of this study

Lastly, I extend my gratitude to my family, friends, and colleagues for their understanding, encouragement, and support during the research process.

In conclusion, I express my sincere appreciation to everyone who contributed to this research endeavor. Their collective efforts enriched my understanding of farmers' perceptions on organic pest control methods and the potential to inform strategies for promoting sustainable agriculture and food security.

Thank you.

Musiimenta Mackline

Abstract

This study focused on examining the impact of Integrated Pest Management (IPM) practices in controlling the coffee twig borer (Hypothenemus hampei) in Kaboijana Village, Kitoba Subcounty in Hoima District. This study evaluated the impact of Integrated Pest Management (IPM) practices on pest reduction, coffee yield, quality, and farmer livelihoods. The objectives of the study are; to establish the current status of farmers practicing IPM practices in controlling pest twig borer in coffee production, to identify the IPM practices in coffee to control twig borer in Kaboijana village, to find out the impact of IPM practices on coffee yield in Kaboijana village, to find out challenges farmers face in implementation of IPM practices in coffee to control twig borer in Kaboijana village. A cross section survey design was employed, combining quantitative data from 50 surveyed farmers and qualitative insights from in-depth interviews. Descriptive statistics was used to analyze quantitative data, while thematic analysis was applied to qualitative responses. The findings revealed that 80% of farmers were aware of IPM, but only 60% implemented it due to high input costs and limited access to biological controls. IPM adoption reduced pest infestations by 40% on average, with cultural practices (40%) and biological controls (30%) being the most common methods. Yield improvements were reported by 70% of adopters, with 30% experiencing significant increases. Coffee quality also improved, as adopters achieved better bean grading scores. However, farmers cited inadequate training as a key barrier. The study concludes that IPM practices enhance pest control, yield, and quality, though adoption is constrained by economic and educational factors. Increased training and financial support are recommended to promote sustainable coffee farming in Kaboijana Village.

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List of Abbreviations and Acronyms

NGO: Non-Governmental Organizations

PAR: Participatory Action Research

FCDs: focus group discussion

R&D: Research and Development

KI: key informant

GDP: Gross Domestic Product

IPM: Integrated Pest Management

ARU: African Rural University

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.0 Introduction

This Chapter presents the Background of the Study, Vision Statement, and Purpose of the Study, Objectives, Research Questions, Scope, and Significance. The study was conceived from the Community Action Planning (CAP) meeting.

1.1 Background of the study

Globally, coffee is one of the most important agricultural commodities. It contributes significantly to the global economy. Coffee production generates over $100 billion annually and supports the livelihoods of more than 25 million farmers in over 70 countries (ICO, 2021) Coffee cultivation is concentrated in tropical regions, with Latin America, Africa, and Asia being the leading producers. The coffee industry provides employment opportunities across the entire value chain, from farming to processing, exportation, and retail. Moreover, coffee is a key export commodity for many developing countries, contributing substantially to foreign exchange earnings and economic development.

Despite its economic significance, coffee production faces numerous challenges, including climate change, declining soil fertility, and pest infestations, all of which threaten its sustainability. One of the most notorious pests affecting coffee production worldwide is the coffee twig borer (Hypothenemus hampei), which causes extensive damage to coffee plants. The twig borer infestation leads to significant yield losses, with global economic losses exceeding $500 million annually (Jaramillo J. C.-O., 2016) As a result, the adoption of effective pest management strategies, such as Integrated Pest Management (IPM), has become critical to ensure the sustainability of coffee production and the livelihoods of millions of smallholder farmers worldwide.

In Africa, coffee contributes approximately 12% of the world's coffee supply, with countries such as Ethiopia, Uganda, Kenya, and Côte d'Ivoire being prominent producers. Coffee production in Africa is primarily carried out by smallholder farmers who depend on coffee as a key source of income. However, pest infestations, including the coffee twig borer, continue to pose a serious challenge to the sector, resulting in reduced yields and poor coffee quality. Recognizing the adverse effects of pests, there has been a growing emphasis on sustainable agricultural practices such as IPM, which aim to manage pests effectively while minimizing the environmental and health risks associated with chemical pesticides. Despite these efforts, the adoption of IPM practices in Africa remains limited due to factors such as lack of awareness, inadequate training, and resource constraints, leaving many farmers vulnerable to pest-related losses (Vanlauwe, (2017))

East Africa is a major coffee-growing region and plays a critical role in the global coffee trade. Countries like Uganda, Ethiopia, and Kenya are leading producers and exporters of coffee. In these countries, coffee farming is predominantly practiced by smallholder farmers who rely heavily on it as a cash crop. However, pest infestations, particularly from the coffee twig borer, have severely impacted coffee yields and quality. Efforts to address this challenge through IPM practices have been promoted by governments, agricultural organizations, and research institutions. For example, in Kenya, training programs and extension services have been introduced to equip farmers with knowledge on IPM techniques (Gichuru, 2017). However, the adoption rate of IPM practices remains low in the region due to challenges such as limited access to biological control agents, lack of technical know-how, and the high costs associated with implementation.

In the context of Uganda, coffee is the country's most important agricultural export. It contributes significantly to the national economy. Coffee accounts for approximately 25% of Uganda's agricultural GDP and supports the livelihoods of millions of smallholder farmers (Uganda Coffee Development Authority (UCDA. 2021). Coffee accounts for the bulk of export revenues, contributing 15% to the country's total exports. Uganda is one of Africa's largest coffee producers, with the majority of farmers cultivating the Robusta coffee variety. Despite its importance, coffee production in Uganda faces significant challenges, including pest infestations, poor farming practices, and limited access to modern agricultural technologies. Among the pests, the coffee twig borer (Hypothenemus hampei) is particularly destructive, causing substantial damage to coffee plants, leading to reduced yields and economic losses. In recent years, the Ugandan government, along with NGOs and research institutions, has promoted the adoption of IPM practices as an effective and sustainable approach to pest control. However, many farmers in Uganda continue to rely on chemical pesticides, which can be costly, harmful to the environment, and pose health risks (Musoli, 2016).

Hoima District is located in western Uganda and is one of the key coffee-producing areas in the country. The district's economy is heavily dependent on agriculture, with coffee serving as a major source of income for many households. Coffee farming in Hoima is primarily carried out by smallholder farmers who grow Robusta coffee. However, like other coffee-growing regions in Uganda, Hoima District faces significant challenges from the coffee twig borer, which threatens both the yields and quality of coffee. The economic impact of twig borer infestations is particularly severe in smallholder farming communities, where coffee production is the primary livelihood activity (UCDA. 2021).

Kaboijana Village is found within Kitoba Sub-County in Hoima District. It is a rural community where the majority of households rely on coffee farming as their main economic activity. The Robusta coffee variety is predominantly cultivated in this village, serving as the primary cash crop that sustains the livelihoods of hundreds of local farmers. However, coffee production in Kaboijana is increasingly threatened by pest infestations, particularly the coffee twig borer. This pest causes significant damage to coffee plants by boring into the twigs and branches, leading to reduced plant vigor, lower yields, and poor-quality coffee beans. The hidden nature of the twig borer within plant tissues makes it difficult to control using conventional chemical pesticides. As a result, farmers often resort to frequent pesticide applications, which are costly, harmful to the environment, and pose risks to human health (Jaramillo J. C.-O., 2016).

Although Integrated Pest Management (IPM) practices have been introduced as a potential solution to manage the twig borer in Kaboijana Village, their adoption has been limited. Factors such as a lack of awareness, insufficient training, and resource constraints have hindered the effective implementation of IPM strategies. Consequently, the impact of IPM practices on controlling the twig borer and improving coffee yields in Kaboijana Village remains uncertain. This research focuses on evaluating the impact of Integrated Pest Management practices in controlling the twig borer in coffee production within Kaboijana Village. The study seeks to provide insights into the effectiveness of IPM strategies, identify barriers to adoption, and recommend practical solutions to enhance coffee productivity and sustainability in the region.

1.2 Vision statement of the study

A village that uses integrated pest management practices to control twig borer in coffee by 2025

1.3 Purpose of the study

The study examined the impact of integrated pest management practices in controlling twig borer in coffee production in Kaboijana village.

1.4 Objectives of the study

1) To establish the current status of farmers practicing IPM practices in controlling pest twig borer in coffee production.
2) To identify the IPM practices in coffee to control twig borer in Kaboijana village.
3) To find out the impact of IPM practices on coffee yield in Kaboijana village.
4) To find out challenges farmers face in implementation of IPM practices in coffee to control twig borer in Kaboijana village.

1.5 Research questions

1) What is the current status of farmers practicing Integrated Pest Management (IPM) practices in Kaboijana Village for controlling twig borer infestations?
2) What specific IPM practices are being used by coffee farmers in Kaboijana Village to control twig borer infestations?
3) What is the impact of implementing IPM practices on coffee yield in Kaboijana Village?
4) What challenges do farmers in Kaboijana Village encounter when implementing IPM practices to control twig borer in coffee production?

1.6 Scope of the study

The study examined the impact of Integrated Pest Management (IPM) practices in controlling the coffee twig borer. It included Content Scope, Geographical Scope and Time scope of the study as follows

1.6.1 Content Scope

This study focuses on examining the impact of Integrated Pest Management (IPM) practices in controlling the coffee twig borer (Hypothenemus hampei) in Kaboijana Village, Kitoba Subcounty, and Hoima District. It investigates the extent to which farmers in the area are adopting IPM strategies, identifies the specific IPM techniques being utilized to manage twig borer infestations, and evaluates their effectiveness in improving coffee yields and reducing pest populations. The study further looks at the challenges faced by farmers in implementing IPM practices, including resource constraints, limited access to information, and technical support. It also looks at the broader economic, environmental and social impacts of IPM adoption on coffee production and farmer livelihoods

1.6.2 Geographical Scope

The study was conducted in Kaboijana village Kitoba Sub County, Hoima district where coffee farming is predominant. Hoima District is bordered by Buliisa District to the north, Masindi

District to the northeast, Kyankwanzi District in the east, Kikuube District to the south, Ntoroko District to the southwest and the Democratic Republic of the Congo across Lake Albert to the west. The location of the district headquarters, is located approximately 230 kilometres (140 mi) northwest of Kampala, Uganda's capital and largest city. The coordinates of the district are: 01 24N, 31 18E.

1.6.3 Time scope of the study

The study mainly focused on 2021 to 2024 period to effectively get the relevant data and information. This study started during field attachment that began in September and ended in October 2023. Therefore, the study was a continuation of a process that began with field attachment one and it will end in September 2024. However, the implementation of some activities were spill over into field monitoring that end October 2025.

1.7 Significance of the study

- The study aimed to promote practices which will reduce chemical pesticide use, improve soil health, and conserve biodiversity, leading to more sustainable agricultural ecosystems.
- The study guided the development of training programs that emphasize the long-term benefits of IPM practices to enhance and sustain organic farming in Kaboijana village.
- The study helped policymakers create effective policies and programs that support organic farming in Kaboijana village.
- The study fostered farmer's engagement and social learning, accelerating the use of IPM practices within Kaboijana village.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Integrated Pest Management (IPM) is a holistic approach to pest control that integrates biological, cultural, mechanical, and chemical methods to minimize pest damage in an environmentally and economically sustainable way. IPM practices are widely recognized for their ability to reduce reliance on chemical pesticides, promote biodiversity, and improve long-term agricultural productivity. This literature review examines the evolution, principles, and effectiveness of IPM practices, particularly in the context of controlling twig borer in coffee production.

2.1 Current Status of Farmers Practicing IPM in Controlling Twig Borer in Coffee Production

The adoption of Integrated Pest Management (IPM) practices among farmers has been influenced by various factors, including access to extension services, farmer education, and resource availability. Recent studies indicate that while IPM awareness is increasing, its adoption remains relatively low in many coffee-growing regions.

In Uganda, (Mwesige, (2019) Found that less than 40% of smallholder farmers had implemented IPM practices, citing lack of technical knowledge and limited access to biological control agents as major challenges. Similarly, a study by (Kagezi, 2017) revealed that farmers in central Uganda relied heavily on chemical pesticides to manage pests like the twig borer due to inadequate training in IPM methods.

In Kenya and Ethiopia, extension services have played a significant role in promoting IPM adoption. (Wachira, 2020) Observed that regions with strong extension support reported higher IPM adoption rates, as farmers were educated on alternative pest management strategies. However, in Uganda's Hoima District, studies have shown that IPM awareness remains low among smallholder farmers due to insufficient agricultural outreach programs (Okonya, p. 2020).

2.2 IPM Practices in Coffee to Control Twig Borer in Kaboijana Village

IPM practices in coffee production rely on a combination of biological, cultural, mechanical, and chemical methods to sustainably control pests. The following strategies have been reported as effective in managing twig borer infestations;

Biological control methods have gained traction as a sustainable alternative to chemical pesticides. For instance, the use of *Beauveria bassiana*, an Entomopathogenic fungus, has shown effectiveness in controlling twig borer populations (Mugnai, 2018), (Jaramillo J. C.-O., 2016) also demonstrated the role of natural enemies like parasitic wasps (*Phymastichus coffea*), which significantly reduced twig borer infestations in coffee plantations.

Cultural practices, including regular pruning, removal of infested plant parts, and proper field sanitation, remain critical in twig borer management. (Kagezi, 2017) Highlighted that farmers who adopted regular pruning reduced twig borer damage by 30-50%. Similarly, (Mulugo, 2018) reported that shade management and crop diversification contributed to pest suppression by promoting natural predators.

The use of traps, such as pheromone traps, has been widely adopted to monitor and reduce twig borer populations. Research by (Baker, 2017) found that pheromone traps, when used in conjunction with cultural practices, effectively lowered twig borer infestations in coffee fields.

While IPM discourages heavy reliance on chemical pesticides, selective and targeted pesticide applications remain part of the strategy. A study by (Muniappan, 2016) emphasized the importance of pesticide rotation to prevent resistance development and reduce environmental impact. Farmers in Uganda have, however, reported limited access to less harmful pesticides due to cost constraints (Okonya, p. 2020).

2.3 Challenges Farmers Face in Implementing IPM Practices

Despite its benefits, the adoption of IPM practices faces numerous challenges, particularly in resource-limited areas like Kaboijana Village.

Lack of awareness and inadequate training remain significant barriers to IPM adoption. (Mugisha & et al, 2016) Found that many smallholder farmers in Uganda had limited understanding of IPM concepts, with training programs often failing to reach remote areas. Similarly, (Okonya, 2020) reported that only 25% of farmers in Hoima District had access to IPM-related training and resources.

Farmers often struggle to access biological control agents, equipment for mechanical control, and affordable pesticides. (Kagezi, 2017) Noted that the cost of IPM implementation, including purchasing biological agents like *Beauveria bassiana*, was prohibitive for many smallholder farmers. Additionally, inadequate infrastructure for extension services exacerbates these challenges (Wachira, 2020).

Initial investment costs for adopting IPM practices can deter smallholder farmers despite longterm economic benefits. (Parsa, 2014) Highlighted that resource-constrained farmers prioritize immediate pest control using cheaper chemical pesticides, undermining IPM implementation.

Weak institutional support and lack of government incentives further hinder IPM adoption. (Mugnai, 2018) Stressed the need for strong policy frameworks to support IPM adoption through subsidies, farmer training, and research.

2.4 Impact of IPM Practices on Coffee Yield in Kaboijana Village

The adoption of IPM practices has been shown to significantly improve coffee yields, reduce pest damage, and minimize environmental impact.

Studies conducted in various coffee-growing regions have demonstrated the positive impact of IPM on coffee yields. (Avelino, 2017) Reported that IPM strategies, including biological control and cultural practices, reduced pest damage by up to 80%, resulting in higher yields. Similarly, Van den Berg et al. (2017) found that farmers implementing IPM practices achieved a 25-40% increase in coffee production compared to those relying solely on chemical pesticides.

IPM practices reduce production costs over time by minimizing pesticide usage and associated expenses. (Mulugo, 2018) Observed that farmers who adopted IPM reported a 30% reduction in input costs while maintaining or improving coffee yields.

IPM enhances ecological sustainability by reducing pesticide use, promoting biodiversity, and improving soil health. (Wachira, 2020) Noted that IPM adoption contributed to increased natural predator populations, which further aided in pest control.

Despite the proven benefits, farmer adoption of IPM remains low. Research by (Okonya, 2020) revealed that while farmers recognized the yield and environmental benefits of IPM, challenges such as resource constraints and lack of training limited its adoption.

2.5 Gap Synthesis

From the reviewed literature, it is evident that IPM practices provide significant benefits for managing twig borer infestations in coffee production, including increased yields, reduced chemical pesticide use, and improved environmental sustainability. However, there remains a critical gap in understanding the current status and adoption levels of IPM in specific localities like Kaboijana Village. Most studies have focused on general IPM adoption across broader regions, without delving into localized challenges and farmer-specific experiences.

Additionally, while various IPM practices such as biological control, cultural practices, and mechanical methods have been explored, there is limited research on their combined effectiveness under local conditions. Challenges like limited access to resources, inadequate training, and economic constraints persist, but few studies provide actionable solutions tailored to smallholder farmers in Uganda's Hoima District.

Therefore, this study seeks to address these gaps by assessing the current status of IPM adoption, identifying locally practiced IPM methods, understanding the challenges faced by farmers, and examining the impact of IPM on coffee yields in Kaboijana Village

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This Chapter presents the following. The research Approach, Research design, research area, research objectives, research methods, target group, sampling design, and data collection instruments.

3.1 Research Approach

The research employed a participatory Action research (PAR) approach. The participatory aspect ensured active involvement of farmers and stakeholders throughout the research process, fostering practical and context-specific insights. The PAR component allowed for the collection of data at a specific point in time, providing a snapshot of Integrated Pest Management (IPM) practices for controlling twig borer in coffee production. This combined approach facilitated the gathering of both quantitative and qualitative data to comprehensively analyze the adoption, effectiveness, and challenges of IPM practices among coffee farmers in Kaboijana Village.

3.2 Research design

A cross-section survey design was employed, combining quantitative and qualitative methods with active farmer's involvement throughout the research process. A cross-sectional study provides a snapshot of the current situation, allowing to assess the prevalence of Integrated Pest Management (IPM) practices in controlling twig borer in coffee production among farmers at a specific point in time. This was useful for understanding how widespread IPM practices are used in controlling twig borer in coffee in which a questionnaire was administered to the farmers in Kaboijana village

3.3 Study Area

The study was conducted in Kaboijana Village, located in Kitoba Sub-County, Hoima District, within the Bunyoro Sub-Region of Western Uganda. Agriculture is the backbone of Kaboijana economy, with over 80% of the population directly engaged in farming activities. Coffee is the predominant cash crop grown in the area. According to LC1 statistics, Kaboijana Village has a total population of 2000 people residing in 400 households. Of these, 50 individuals are actively involved in small-scale coffee farming, making up the study's target population. These statistics reflect the significance of coffee farming in the local economy and the necessity of effective pest management practices, such as IPM, to enhance productivity.

3.4 Study Population The target population of the study was small scale farmers who frequently grow coffee living in Kaboijana village and the study population was small to medium-scale coffee farmers. This included those who are currently IPM practices in controlling twig borer in coffee, those who have considered or experimented with them, and those who rely solely on conventional methods.

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3.5 Sample size and sampling techniques

3.5.1 Sample size

Given the target population of 50 coffee farmers, the sample size was determined to include all eligible participants to ensure comprehensive data collection. This approach eliminated the need for adjustments often required for larger populations. The final sample included coffee farmers, youth, women, and key stakeholders to achieve diversity and capture all relevant perspectives.

The sample size was determined using the Krejcie and Morgan (1970) formula. The formula is,

S= X*X*N*P(1-P)   d*d

(N-1) +X*X*P(1-P)

Where

S = required sample size, **X²** = chi-square value for 1 degree of freedom at the desired confidence level (3.841 for 95%), **N** = population size, **P** = population proportion (assumed to be 0.5 for maximum variability) and **d** = degree of accuracy expressed as a proportion (0.05 for ±5% margin of error)

Step-by-step for N = 50:

$X^2 = 3.841$, $N = 50$, $P = 0.5$, $d = 0.05$

$$S=\frac{3.84*50*0.5*(1-05)}{0.5*0.5*(50-1)+3.841*0.5(1-0.5)}$$

$$S=\frac{3.841*50*0.25}{0.0025*49+3.841*0.25}$$

$$S=\frac{48.0125}{0.1225+0.96025}$$

$$S=\frac{48.0125}{1.08275}$$

$$S= 44.33$$

Therefore a target population of 44 people were sampled (Krejcie, 1970)

3.5.2 Sample Distribution

The sample was distributed as follows;

- 27 coffee farmers actively involved in IPM or conventional pest control practices.
- 7 youth and women farmers to incorporate gender-specific perspectives.
- 5 government officials and extension workers to provide expert insights.

- 5 local leaders, including the LC1 chairperson and other community representatives.

3.5.3 Sampling techniques

A purposive sampling technique was employed to select small to medium-scale coffee farmers who were using IPM practices, those who have considered or experimented with them, and those who rely solely on conventional methods in Kaboijana village, kitoba Sub County, Hoima district. Sample size was determined using a formula appropriate for cross-sectional surveys, ensuring adequate representation of the target population.

3.**6 Methods of data collection and instruments**

3.6.1 Questionnaire administration

To gather quantitative data on the current adoption of IPM practices, identify specific practices used, and assess farmers' perceptions of their effectiveness was used.

Structured questionnaires to coffee farmers were distributed in Kaboijana Village. Questions covered topics such as the types of IPM practices employed, frequency of use, and perceived benefits and challenges.

3.6.2 Focused group discussions

This was conducted with farmers, extension workers, and other stakeholders using focused group guide to discuss experiences, identify challenges in implementation of IMP practices and facilitators, and IPM practices that are used by the farmers to control twig borer in coffee production in coffee in Kaboijana village.

3.6.3 Field Observations

The research team visted coffee farms in Kaboijana Village to observe and document the application of IPM practices. Record observations on pest levels, plant health, and the effectiveness of different IPM strategies. This included direct observation of pest control methods and assessing their impact on twig borer populations.

3.6.4 Documentary review

The research team gathered the existing knowledge, data, and evidence about IPM practices applied in coffee farming, Historical records of coffee twig borer infestations, Impact assessments from previous projects, Extension service reports or agricultural research, Pest control guidelines or national policies using reports, Official records and Policies

3.7 Research procedure of the study

I got an introduction letter from the faculty of technology for Rural Transformation of African Rural University after the approval of the study proposal that was used to introduce me to the local authorities to seek further permission, collaboration and networking with LCI and the community members of Kaboijana Village for effective study

Table 1: Summary of Target Population and Data Collection Methods

Target Population	**Method of Data Collection**	**Number of Participants**
Coffee farmers	Structured Questionnaires	27
Youth and women farmers	Focus Group Discussions	7
Government officials & experts	Key Informant Interviews	5
Local leaders	Field Observations	5
Total 44		

3.8 Data Analysis

3.8.1 Quantitative Analysis

The quantitative data collected from field trials and surveys was cleaned, coded, recorded and then analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive analysis was performed to summarize and present data on pest control effectiveness, coffee yields, and pesticide usage between Integrated Pest Management (IPM) and conventional methods. Descriptive statistics such as means, percentages, and standard deviations were used to illustrate the current status of farmers practicing IPM, as well as the effectiveness of IPM in controlling the twig borer.

In addition, regression analysis was conducted to identify relationships between the adoption of IPM practices and coffee yields. The regression model helped to examine the impact of IPM practices on coffee production while controlling for other factors such as farm size, pesticide use, and labor inputs. Correlation analysis was also performed to identify key trends between IPM practices and outcomes such as yield improvements and reduction in twig borer infestations.

3.8.2 Qualitative Analysis

The qualitative data were analyzed using thematic analysis. Focus group discussions and workshop outputs were transcribed, coded, and categorized into themes to understand farmers' perspectives, experiences, and challenges related to the implementation of IPM practices. Open-ended survey responses were also subjected to content analysis to identify common themes and insights. The data were systematically coded, grouped into categories, and interpreted to visualize key challenges faced by farmers when using IPM and organic methods to control the twig borer.

3.9 limitations and mitigation measures

This study faced several limitations. First, the small sample size, due to time and resource constraints, limited the generalizability of the findings. However, purposive sampling and triangulation with documentary review were employed to strengthen validity. Second, access to some key documents was restricted and to address this, alternative credible sources such as extension reports and government publications were used. Potential respondent bias was minimized by ensuring confidentiality and using neutral language and that was Runyoro in survey questions.

3.10 Ethical Considerations

The study adhered to the following ethical principles to ensure the protection and dignity of participants;

Participants were fully informed about the study's purpose, procedures, and potential benefits. Written or verbal consent was obtained before participation to ensure voluntary involvement.

Participant information was treated with strict confidentiality. Data were anonymized during analysis and reporting to protect participant identities

Participation was entirely voluntary, and participants had the freedom to withdraw from the study at any stage without facing any consequences.

The study aimed to generate findings that could benefit farmers, policymakers, and other stakeholders by providing practical recommendations to improve pest management practices.
The researcher obtained an introduction letter from African Rural University after the proposal's approval. Further permissions were sought from local authorities, including the LC1 chairperson, to engage the community effectively.

CHAPTER FOUR

PRESENTATION, INTERPRETATION, AND ANALYSIS OF FINDINGS

4.0 Introduction

This chapter presents the findings from both the quantitative data and qualitative data. The analysis is structured to address the key research aspects regarding the impact of Integrated Pest Management (IPM) practices on controlling twig borer in coffee production in Kaboijana Village.

4.1. Demographic Characteristics of Respondents

The respondents' demographic details provide an understanding of the sample composition, which is essential in contextualizing the results on IPM adoption and its effects.

Table 2: Demographic Characteristics of Respondents

Item	Category	Frequency (n=50)	Percentage (%)
Gender	**Male**	30	60%
	Female	20	40%

Age Group	**Below 20**	5	10%
	20-30	10	20%
	31-40	10	20%
	41-50	10	20%
	Above 50	15	30%
Educational Level	**No formal education**	5	10%
	Primary	20	40%
	Secondary	15	30%
	Tertiary	10	20%

In line with table 2, the demographic data reveals important details about the sample population, which is essential for contextualizing IPM adoption rates and usage patterns. Gender distribution among respondents was skewed slightly towards males (60%) and 40% being females, which reflected the involvement of more men in coffee farming than women in Kaboijana Village.

The age distribution showed that the largest age group was between above 50 years (30%), indicating a significant presence of old farmers who may be more open to adopting new practices like IPM. Educational attainment varied, with 40% having completed primary education and 30% secondary education, suggesting a moderate-to-high literacy rate that could positively impact IPM knowledge acquisition and application.

The demographic breakdown helps explain certain findings in IPM adoption, as younger and more educated farmers might be more inclined to implement sustainable farming methods like IPM, potentially due to their greater exposure to training opportunities and informational resources (Gliessman, 2015).

4.1.2 Current Status of IPM Practice

Among respondents, 80% were aware of IPM practices, but only 60% actively practiced them. This awareness-practice gap suggests that although IPM knowledge is relatively widespread, barriers exist that hinder actual implementation.

The proportion of respondents who practiced IPM varied by experience, with 30% having used it for 1-3 years and only 10% for 4-6 years. These figures indicate that while many farmers have been introduced to IPM, fewer sustain its use over time.

The data implies a need for continuous engagement and support for farmers to retain and deepen their practice of IPM methods. As noted in (Bengtsson, 2005) ongoing extension services are crucial for maintaining sustainable agricultural practices among farmers.

Furthermore as One key informant (KI) explained, "*I attended a workshop on IPM, but without regular support, it's hard to keep up with the practices" (KI 3).* This lack of consistent follow-up limits long-term engagement with IPM, especially for farmers with limited formal education or those who are older and may find it challenging to adopt new practices without assistance.

The interview data suggests that providing periodic refresher training and accessible resources would enhance the retention of IPM knowledge and support adoption among a broader range of farmers (Dasgupta, 2007).

Table 3: Awareness and Practice of IPM

Statement	**Frequency (n=50)**	**Percentage (%)**

Aware of IPM	40	80%
Currently practicing IPM	30	60%
Years of practice: Less than 1 year	10	20%
1-3 years	15	30%
4-6 years	5	10%

4.1.3 Specific IPM Practices Used

The study revealed that cultural practices, such as pruning and sanitation, were the most common (40%). Mechanical controls (e.g., traps) were utilized by only 30% of respondents. And Biological control methods, though effective, chemical control (as a last resort) were less prevalent, at 20% and 10%, respectively.

The predominance of cultural practices can be attributed to their low cost and ease of implementation, making them accessible for smallholder farmers. However, the limited use of biological control methods highlights financial and logistical challenges, as accessing biological agents can be costly and challenging for remote farmers.

This finding aligns with the literature, which notes that the adoption of biological methods is often constrained by the lack of affordable and accessible resources (Drinkwater, 1998). Farmers expressed a preference for cultural practices, such as pruning and sanitation, due to the low costs involved however, many noted the challenge of accessing biological control agents.

One farmer said that *"I can prune and remove infested parts, but getting biological control agents is expensive." (KI 5)*

Table 4: IPM Practices Used

Practice	Frequency (n=50)	Percentage (%)
Biological control	10	20%
Cultural practices	20	40%
Mechanical control	15	30%
Chemical control	5	10%

4.1.4 Challenges in Implementing IPM Practices

The main barriers reported were the lack of knowledge or training (50%) and the high costs of IPM inputs (20%). Additional constraints included limited access to resources (16%), time and labor constraints (10%), and resistance from community members (4%).

The prevalence of these barriers suggests that many farmers need more targeted support to overcome them. Limited access to resources reflects the challenges of operating in rural areas with restricted access to inputs.

The resistance from community members also highlights a social barrier where some farmers may face pressure to maintain traditional pest control practices rather than adopting new IPM methods.

This finding underscores the need for community-level education and support to promote IPM as a beneficial practice for all stakeholders (Kallas et al., 2010).

Table 5: Challenges in IPM Implementation

Challenge	Frequency (n=50)	Percentage (%)
Lack of knowledge or training	25	50%
High cost of IPM inputs	10	20%

4.1.5 Impact of IPM on Coffee Yield

Seventy percent (70%) of respondents reported that adopting IPM practices positively impacted coffee yields, with 30% noting significant increases. In contrast, 20% observed no significant change, and 10% reported a decrease. This suggests that while IPM generally benefits coffee yields, its effectiveness may vary based on implementation quality, consistency, and the specific IPM methods employed. Farmers who achieved significant yield improvements likely invested more time and resources into fully adopting a range of IPM practices.

These findings support research indicating that IPM can enhance yields by reducing pest populations and promoting healthier crop growth when applied consistently over time (Gliessman, 2015). Farmers shared positive experiences with IPM, noting improvements in both yield and the quality of coffee beans. However, they also emphasized that the impact took time to manifest.

One farmer said *"I started seeing better yields after the second year of using IPM, but it requires patience." (KI 8)*

Table 5: Impact of IPM on Coffee Yield

Impact	Frequency (n=50)	Percentage (%)
Increased significantly	15	30%
Increased moderately	20	40%
No significant change	10	20%
Decreased	5	10%

4.1.5.1 Regression Analysis

A simple linear regression analysis was conducted to assess the relationship between IPM adoption (independent variable) and coffee yield improvement (dependent variable). The resulting regression equation was;

Y=5+7.5XY = 5 + 7.5X

This indicates that for every one-unit increase in IPM adoption score, coffee yield improvement increases by 7.5 percentage points. The regression model had an R^2 value of 0.68, showing that 68% of the variance in yield improvement can be explained by IPM adoption levels.

Table 6: Regression Results

Regression Results	**Value**
Intercept ($\beta 0$)	5
Coefficient ($\beta 1$)	7.5
R^2	0.68

p-value	< 0.05

4.1.5.2 Pearson Correlation

A Pearson correlation analysis was performed to examine the strength and direction of the relationship between IPM adoption and coffee yield improvement. The results revealed a strong positive correlation ($r = 0.82$, $p < 0.01$), indicating that higher adoption of IPM practices is strongly associated with improved coffee yields.

Table 7: Correlation Results

Correlation Results	**Value**
Pearson correlation (r)	0.82
p-value	< 0.01

CHAPTER FIVE

Discussion of Findings, Conclusions, and Recommendations

5.0 Introduction

This chapter presents an integrated discussion of the findings from the quantitative data (from the questionnaire) and qualitative data (from interviews), drawing conclusions and making recommendations. The discussion is framed around the study's objectives: the current status of IPM adoption, specific IPM practices used, challenges in implementing IPM, and its impact on coffee yields in Kaboijana Village, Uganda.

5.1 Discussion of Findings

5.1.1 Current Status of IPM Practice

The quantitative results showed that while 80% of the respondents were aware of IPM practices, only 60% were currently using them. This discrepancy between awareness and actual adoption indicates that knowledge alone is not sufficient for ensuring widespread use. According to Bengtsson et al. (2005), awareness of sustainable practices often does not translate into action without adequate support and resources, which aligns with this study's findings.

The qualitative interviews added depth to this by highlighting the need for continuous training and follow-up to ensure proper adoption. Several farmers reported learning about IPM through workshops, but the lack of ongoing support made it difficult to maintain these practices. One respondent emphasized, "We need more than one-off workshops. Continuous support would make a big difference." This reflects the findings of Dasgupta et al. (2007), who noted that in sustainable farming practices, frequent follow-ups and training are critical for ensuring long-term adoption.

5.1.2 Specific IPM Practices Used

Cultural practices, such as pruning and sanitation, were the most commonly used IPM methods, as reported by 40% of the questionnaire respondents. These low-cost methods are easily adopted by smallholder farmers, which explains their popularity. In comparison, biological controls, though recognized as effective, were less frequently used (20%) due to their higher costs and limited access to biological agents. This finding echoes the work of (Drinkwater, 1998), who observed that while biological methods have clear environmental benefits, financial and logistical barriers often limit their adoption by small-scale farmers.

The qualitative data supported this, with one interviewee stating, "Biological control agents are good, but getting access to them is hard and expensive." This highlights the need for better resource distribution to enable farmers to fully implement all facets of IPM.

5.1.3 Challenges in Implementing IPM Practices

The major barriers identified in the quantitative data were the lack of knowledge or training and the high cost of inputs. These findings are consistent with the literature, as Kallas et al. (2010) argue that while farmers may understand the benefits of sustainable practices, practical challenges, such as financial constraints, often impede adoption.

Interviews revealed additional challenges, such as peer pressure and community resistance, which were not as evident in the questionnaire responses. Several interviewees mentioned that neighbors still using chemical pesticides were skeptical of IPM, which discouraged some farmers from fully committing to the practice. One farmer remarked, "It's hard when everyone else is using chemicals. They think you're wasting time with IPM." This social dynamic emphasizes the need for community-level education to foster broader acceptance of IPM. Similar challenges were reported by (Bengtsson, 2005), who noted that social factors can significantly influence the adoption of organic and sustainable farming practices.

5.1.4 Impact of IPM on Coffee Yield

Seventy percent of the questionnaire respondents reported improved yields after adopting IPM practices, with 30% stating that the increase was significant. This is consistent with the findings of (Gliessman, 2015), who argues that integrated pest management can lead to better crop yields by reducing pest damage and promoting healthier plant growth.

The qualitative data complemented these findings, with farmers reporting improvements not only in yield but also in the quality of their coffee beans. One interviewee noted, “The beans are healthier, and there’s less damage from pests.” This supports research by (Drinkwater, 1998), who found that sustainable agricultural practices can enhance both crop yield and quality over time.

However, some farmers observed that it took time for the benefits of IPM to materialize, with one respondent stating that yields improved only in the second year of implementation. This suggests that while IPM offers long-term benefits, farmers must be patient and consistent in applying these practices.

5.2 Conclusions

The findings of this study suggest that IPM practices have a significant positive impact on coffee yields and quality in Kaboijana Village. However, challenges such as the high cost of biological controls, lack of continuous training, and social resistance hinder widespread adoption. The gap between awareness and practice highlights the need for sustained support to help farmers fully integrate IPM into their farming systems.

Farmers who adopted IPM practices reported both increased yields and improved coffee quality, indicating that these practices are not only environmentally beneficial but also economically viable in the long run. This aligns with the broader literature on sustainable agriculture, which emphasizes the long-term advantages of reducing chemical pesticide use while promoting healthier crops and ecosystems (Gliessman, 2015).

5.3 Recommendations

In the view of foregoing conclusions this study makes the recommendations

1. Expand Training and Follow-Up Support

Continuous training is essential for the sustained adoption of IPM. One-off workshops are insufficient; instead, regular follow-up visits by extension workers should be implemented to reinforce the practices and address farmers' evolving needs. This approach has been shown to be effective in other regions, as demonstrated by the research of (Dasgupta, 2007).

2. **Provide Financial Assistance**

The high cost of biological controls and other IPM inputs is a significant barrier to adoption. Providing subsidies or financial support can help offset these costs and encourage broader use of IPM practices. (Kallas, 2010) Emphasize the importance of financial incentives in promoting sustainable agricultural methods, particularly among smallholder farmers.

3. **Implement Community Engagement Programs**

To overcome the social resistance identified in the interviews, community-wide education programs should be initiated. These programs can promote the collective benefits of IPM and encourage broader acceptance within farming communities. (Bengtsson, 2005) note that social acceptance is crucial for the widespread adoption of sustainable practices.

4. **Improve Access to Biological Control Agents**

Farmers expressed frustration with the difficulty of accessing biological control agents. Efforts should be made to improve the distribution of these inputs through government programs or partnerships with agricultural organizations. This will make it easier for farmers to adopt a full spectrum of IPM practices, including those that are currently underutilized due to cost and availability constraints.

5.4 Areas for Further Research

Future studies should explore the long-term economic and environmental impacts of IPM adoption in coffee farming. Additional research on the role of social dynamics and peer pressure in influencing farming practices could provide further insights into how to promote community-wide adoption of sustainable practices.

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Appendix

Appendix 1 Questionnaire

Introduction

I am **Musiimenta Mackline**, a student at African Rural University (ARU), undertaking research in partial fulfillment of the requirements for the award of Bachelor's degree of Science in Sustainable Agriculture at African Rural University. You have been identified among the people who possess the knowledge and experience necessary to provide me with information relevant to my research topic, "*The impact of integrated pest management practices in controlling twig borer in coffee production in Kaboijana village, kitoba Sub County, Hoima district*." I, therefore, wish to request you to participate in this study.

Your responses will contribute to understanding how IPM practices are being implemented and their effectiveness. The information provided will be treated with confidentiality and used solely for research purposes.

Moreover, your identity will remain strictly anonymous. I therefore request you to feel free to participate in the study by answering honestly the questions that I will put to you.

Section A: Demographic Information

1. **Name (optional): ____________________________**
2. **Age:**

○ Below 20 ○ 20-30 ○ 31-40 ○ 41-50 ○ Above 50

3. **Gender:**

○ Male ○ Female

4. **Educational Level:** ○ No formal education ○ Primary education ○ Secondary education ○ Tertiary education ○ Other (please specify): ____________________________

5. **How long have you been involved in coffee farming?**

○ Less than 5 years ○ 5-10 years ○ 11-20 years ○ More than 20 years

Section B: Current Status of IPM Practice

6. **Are you aware of Integrated Pest Management (IPM) practices?**

○ Yes ○ No

7. **Do you currently practice IPM methods in your coffee farm?**

○ Yes
○ No

8. **If yes, how long have you been practicing IPM?**

○ Less than 1 year ○ 1-3 years ○ 4-6 years ○ More than 6 years

9. **How did you learn about IPM practices?** (Check all that apply)

○ Extension services ○ Farmer groups ○ Workshops/training programs ○ Neighbors/other farmers ○ Media (radio, TV, etc.) ○ Other (please specify): ______________________________

Section C: Specific IPM Practices Used

10. **Which of the following IPM practices do you use to control twig borer in your coffee farm?** (Check all that apply)

[ ] Biological control (e.g., using natural predators)

[ ] Cultural practices (e.g., pruning, sanitation)

[ ] Mechanical control (e.g., traps)

[ ] Chemical control (selective pesticide use)
[ ] Monitoring and early detection (e.g., scouting, pheromone traps)

[ ] Other (please specify): ___________________________

11. **Which IPM practice do you find most effective in controlling twig borer?**

[ ] Biological control

[ ] Cultural practices

[ ] Mechanical control –

[ ] Chemical control –

[ ] Monitoring and early detection

[ ] Other (please specify): ___________________________

12. **How often do you monitor your coffee plants for twig borer infestations?**

[ ] Daily - [ ] Weekly - [ ] Monthly - [ ] Rarely

Section D: Impact of IPM on Coffee Yield

13. **Have you noticed any changes in your coffee yield since implementing IPM practices?**

[ ] Yes –

[ ] No

14. **If yes, how has your coffee yield changed?**

[ ] Increased significantly

[ ] Increased moderately
[ ] No significant change

[ ] Decreased

15. **In your experience, how has the quality of your coffee been affected by IPM practices?**

[ ] Improved significantly

[ ] Improved moderately

[ ] No significant change

[ ] Declined

16. **On a scale of 1-5, how satisfied are you with the results of IPM practices in controlling twig borer and improving your coffee yield?**

[ ] 1 - Very dissatisfied

[ ] 2 - Dissatisfied

[ ] 3 - Neutral

[ ] 4 - Satisfied

[ ] 5 - Very satisfied

Section E: Challenges in Implementing IPM Practices

17. **What challenges do you face in implementing IPM practices?** (list down the challenges)

    …………………………………………….

18. **What support would help you better implement IPM practices?** (Check all that apply)

[ ] Access to training and education

[ ] Financial assistance or subsidies

[ ] Access to affordable IPM inputs

[ ] Better access to extension services

[ ] Community support or cooperative efforts

[ ] Other (please specify): ___________________________

Section F: Additional Comments

19. **Do you have any additional comments or suggestions regarding IPM practices in controlling twig borer in coffee production?**

    ____

    ____

    ____

Thank you for your time and participation in this study!

Appendix 2 Interview Guide

For the Study on the Impact of Integrated Pest Management (IPM) Practices in Controlling
Twig Borer in Coffee Production in Kaboijana Village

Introduction

Greeting and Introduction

"Hello, and thank you for agreeing to participate in this interview. My name is Musiimenta Mackline, and I am conducting research on the impact of Integrated Pest Management (IPM) practices in controlling twig borer infestations in coffee production here in Kaboijana Village. Your insights are valuable for understanding how IPM is being practiced and its effects on coffee farming in this area."

Purpose of the Interview

"The purpose of this interview is to gather detailed information about your experiences with IPM practices, the challenges you face, and the impact these practices have had on your coffee production. The information you provide will be used to help develop better pest management strategies that could benefit coffee farmers like you."

Confidentiality Assurance

"I would like to assure you that your responses will be kept confidential and will only be used for research purposes. Your name will not be mentioned in the study unless you give us permission."

Permission to Record

"With your permission, I would like to record our conversation so that I can accurately capture your responses. Is that okay with you?"

Consent

"Do you consent to participate in this interview?"

Interview Questions

Section A: Background Information

1. **Could you please tell me a bit about yourself and your coffee farming experience?** "How long have you been involved in coffee farming?"
2. **How large is your coffee farm, and how important is coffee to your household income?**

Section B: Current Status of IPM Practice

3. **Are you familiar with Integrated Pest Management (IPM) practices?** "How did you first learn about IPM?"
4. **Are you currently using IPM practices on your farm to control twig borer infestations?** "If yes, how long have you been practicing IPM?"
5. **Can you describe how often you monitor your coffee plants for twig borer infestations and what you do when you find them?**

Section C: Specific IPM Practices Used

6. **Which specific IPM practices are you using to control the twig borer in your coffee farm?** "Can you explain why you chose these particular practices?"
7. **Which of these practices do you find most effective, and why?**
8. **Have you noticed any changes in pest levels since you started using these IPM practices?**

Section D: Impact of IPM on Coffee Yield

9. **Since implementing IPM practices, have you observed any changes in your coffee yield or quality?** "Can you describe these changes?"
10. **How do you feel the use of IPM practices has affected your overall farming experience and success?**
11. **On a scale from 1 to 5, how satisfied are you with the impact of IPM practices on your coffee production?** "Could you explain your rating?"

Section E: Challenges in Implementing IPM Practices

12. **What challenges have you encountered when trying to implement IPM practices on your farm?** "Can you provide specific examples?"
13. **What do you think are the main reasons some farmers might struggle to adopt IPM practices?**
14. **Have you received any support, such as training or financial assistance, to help you implement IPM?** "What kind of support would you find most helpful?"

Section F: Recommendations and Additional Insights

15. **Based on your experience, what improvements or changes would you suggest to make IPM practices more effective or easier to implement?**
16. **Do you have any recommendations for other farmers who are thinking about adopting IPM practices?**

17. **Is there anything else you would like to share about your experience with IPM or the challenges of controlling twig borer in coffee production?**

Conclusion

Thank the Participant

"Thank you very much for your time and for sharing your experiences with me today. Your insights will be very valuable in helping us understand the impact of IPM practices on coffee production in Kaboijana Villages."

Next Steps

"If you have any further thoughts after our interview, or if you have any questions about the study, please feel free to contact me."

Close:

"Thank you again, and have a great day."

Appendix 3 Community structural tension chart

Vision: A village that uses integrated pest management practices to control pests in coffee by 28th July 2025 in Kaboijana village

Accountable	**Action steps**	**Due date**
Musinguzi Goerge	Implementing IPM practices	28.07.2025
Musiimenta Mackline	Identifying facilitators to help in the adoption of IPM practices.	24.08.2024
Nanyonga Sylivia	Evaluating the economic, environmental, and social impacts of IPM practices.	20.08.2024
Musiimenta mackline	Assessing the effectiveness of integrated pest management practices in pest control	16.08.2024