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PREVALENCE OF STORAGE PESTS IN SELECTED BEAN VARIETIES IN BUTIRU SUB COUNTY MANAFWA DISTRICT

BY

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DECLARATION

I **MASETTE JACOB** declare that this research report is my original work. It has not been submitted to any other University or higher institution for any award and where it is indebted to work for others.

Signature: ..... Date: 22nd/01/2024

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APPROVAL

I hereby certify that this work entitled PREVALENCE OF STORAGE PESTS IN SELECTED BEAN VARIETIES IN BUTIRU SUB COUNTY MANAFWA DISTRICT has been submitted with my approval for examination as University supervision.

Signature:..... Date: 22/01/2024

MR. DRAMADRI GERALD AFOYO

SUPERVISOR

DEDICATION

To my beloved parent Mr. MASETTE LWARENCE and Mrs. KHAKUSUMA AGNES for their financial support towards my education

May God reward them abundantly

ACKNOWLEDGEMENTS

I thank the lord almighty for keeping, protecting and giving me good health during the course of my study.

I would like to appreciate the work of my supervisor **MR DRAMADRI GERALD AFOYO** who diligently guided me during my research. May the Almighty reward him abundantly?

Special thanks go to my mother and father for their love and support in form of finance for this particular course of study.

Further thanks to my friends like Wasakina Julius Malongo and others who stood with me and guided on the few things coursening this research.

I also wish to thank my teachers for their advice, knowledge and guidance towards my education. May God bless them

LIST OF ACRONYMS AND ABREVIATIONS

BSCM	BUTIRU B COUNTY MANAFWA DISTRICT
POSP	PREVELENCE OF STOTRGE PESTS
D.A	DATA ANALYSIS
E.C	ETHICAL CONSIDERATIONS

ABSTRACT

Introduction: Beans are an important staple crop in Butiru Sub-County, but their storage and preservation are challenged by infestations from various pests. This research aims to determine the prevalence of storage pests infesting beans in Butiru Sub-County.

Methods and materials: The study involved collecting samples of stored beans from different locations in the sub-county and assessing them for pest damage. Additionally, both qualitative and quantitative methods were employed to identify the types and abundance of pests present. The obtained data was analyzed using descriptive statistics and thematic analysis to determine the prevalence of storage pests and their impact on the quality and quantity of stored beans.

Results: This study found out that the overall prevalence of storage pests in the selected bean varieties in Butiru Sub-County was found to be high as approximately 70% were infested with storage pests. The prevalence of storage pests varied significantly between different locations within Butiru Sub-County. Bunambafu village highest 80%, Bushakiro Village lower 60%. During the rainy season, the prevalence of storage pests was higher, with approximately 75% and during the dry season, the prevalence of storage pests decreased to around 55%. The most common storage pests found in the selected bean varieties were the bean weevil (Callosobruchus maculatus) and the maize weevil (Sitophilus zeamais). The bean weevil accounted for approximately 60% of the storage pest population, while the maize weevil accounted for around 30%. Other storage pests, such as the cowpea weevil (Callosobruchus chinensis) and the grain moth (Sitotroga cerealella), were also present but in smaller populations. The current pest management practices in Butiru Sub-County were found to be ineffective in controlling storage pests in beans. Farmers mainly relied on traditional methods such as chemical pesticides, which were not sufficient in addressing the storage pest problem.

Conclusion: By implementing the recommended pest management strategies, farmers can reduce post-harvest losses and improve food security in the Butiru Sub-County.

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CHAPTER ONE: INTRODUCTION

1.1 Background

Bean storage pests are a major threat to the quality and quantity of stored beans, causing significant losses to farmers and food security in many parts of the world (Endshaw & Hiruy, 2020). In Uganda, bean storage pests are a common problem, with several species of pests infesting stored beans and causing damage (Mutungi et al., 2020). A study by Jayas, White, and Muir (2018), Storage pests pose a significant threat to post-harvest quality and quantity of agricultural commodities, including beans. The authors emphasize the importance of understanding the prevalence and behavior of pests to develop effective management strategies. Daglish, Nayak, Pavic, Smith, and Burrill (2016) investigated the infestation patterns of stored grain pests and highlighted the need for integrated pest management approaches to control infestations. While their study focused on grain pests, the findings are relevant to understanding Storage pests in general. In a study by Nansen, Guedot, and Riddle (2017), the authors examined the impact of Storage pests on common bean quality and emphasized the economic losses incurred by farmers. The study underscored the need for improved pest management practices to reduce losses. A research paper by Manley (2019), investigated the influence of storage conditions on the development and reproduction of bean weevils (Acanthoscelidesobtectus). Their findings revealed the significance of temperature and relative humidity in pest population dynamics. The work of Navarro (2020), explored the efficacy of botanical extracts as potential alternatives to synthetic insecticides for controlling Storage pests. Their study highlighted the importance of environmentally friendly pest management options. A study by Campos, Silva, and Oliveira (2018) investigated the prevalence of Storage pests in common bean cultivators and identified species such as Sitophiluszeamais and Callosobruchusmaculatus as major pests. The research emphasized the need for crop-specific pest management strategies. In a review article by Njoroge, Muthomi, and Chemining'wa (2019), the authors provided an overview of the major Storage pests affecting common beans. They discussed the biology, behavior, and control options for pests such as Storage pests, weevils, and moths. A study by da Silva, de Oliveira, and da Conceição (2020), examined the impact of bean pests on grain quality parameters, including moisture content and germination rate. The findings emphasized the importance of maintaining optimal storage conditions to minimize infestation and preserve grain quality. In a recent study by Ma and Liu (2022), the

authors explored the potential of modified atmospheres to control Storage pests in beans. The research demonstrated the effectiveness of controlled gas environments in reducing pest populations and preserving bean quality. The work of Oliveira, da Silva, and de Oliveira (2021) investigated the influence of storage time and temperature on the occurrence of Storage pests in stored beans. The study highlighted the impact of storage conditions on pest prevalence and emphasized the need for proper storage practices to prevent infestations. Other most common storage pests affecting beans in Uganda include; Cowpea weevil (Callosobruchus maculatus), the most prevalent storage pest of beans in Uganda, causing significant damage to the crop (Weldekidan, 2019). Bean beetle (Rhynchopus latifrons), which is also common in Uganda and causes damage to both stored and fresh beans (Martinossi-Allibert et al., 2018). Stored product pests such as the red flour beetle (Tribolium castaneum), the sawtoothed grain beetle (Oryzaephilus surinamensis), and the maize weevil (Sitotroga cerealella), infest stored beans and cause damage, especially when the beans are not properly dried or stored (Mesele, Dibaba, Garbaba, & Mendesil, 2022). Studies have shown that the prevalence of storage pests in beans can vary depending on several factors, including the location, time of year, and storage conditions (Befikadu, 2014). For example, a study conducted in Uganda found that the prevalence of cowpea weevil and bean beetle in stored beans was higher during the dry season than during the rainy season (Mesele et al., 2022). To mitigate the impact of storage pests on beans, several integrated pest management (IPM) strategies have been developed, including the use of chemical and biological control methods (Chandler et al., 2011). However, these strategies can be costly and may not be accessible to all farmers, particularly smallholder farmers in developing countries (Martinossi-Allibert et al., 2018). Therefore, there is a need for more effective and sustainable IPM strategies that can be implemented by smallholder farmers in Uganda and other parts of sub-Saharan Africa.

1.2 Problem statement

The prevalence of storage pests in selected bean varieties is a significant concern for the agricultural industry. Storage pests can cause substantial economic losses by damaging stored beans, reducing their quality, and rendering them unfit for consumption or sale. This research aims to investigate the extent and impact of storage pests in specific bean varieties to develop effective management strategies and mitigate their adverse effects on bean storage The prevalence of storage

pests in bean varieties has been a persistent issue globally. According to recent studies (Kpoviessi, Agbahoungba, Agoyi, Chougourou, & Assogbadjo, 2019), storage pests such as the cowpea weevil (Callosobruchus maculatus) and the bruchid beetle (Acanthoscelides obtectus) have been identified as major threats to various bean varieties. These pests not only cause direct damage to the beans but also contribute to post-harvest losses, affecting food security and economic stability in agricultural communities. The impact of storage pests on bean varieties extends beyond physical damage, as infestations can lead to mycotoxin contamination, posing health risks to consumers.The research will focus on selected bean varieties commonly cultivated in the target region, including but not limited to black beans, pinto beans, kidney beans, and navy beans. These varieties have been chosen due to their economic importance and susceptibility to storage pest infestations. The primary storage pests of concern include the cowpea weevil (Callosobruchus maculatus) and the bruchid beetle (Acanthoscelides obtectus), which have been reported as prevalent in stored bean crops (Kpoviessi et al., 2019)

1.3 Objectives

1.3.1 General Objective

1. To assess and compare the prevalence of Storage pests in Beans and their impact on post-harvest losses in the designated geographic area.

1.3.2 Specific objectives

1. To identify the prevalence of Storage pests infesting Beans in Butiru Sub-County, Manafwa District
2. To assess how the specific types of Storage pests, vary in their populations within the selected bean varieties in the study area
3. To identify effective pest management strategies to mitigate Storage pests in Beans in Butiru Sub-County, Manafwa District

1.4 Research questions

1. What is the difference in prevalence of Storage pests between Beans in Butiru Sub-County, Manafwa District?

2. How do specific types of Storage pests, vary in their populations between the selected bean varieties?
3. What are the effective pest management strategies to mitigate Storage pests in Beans in Butiru Sub-County, Manafwa District

1.5 Significance of the study

The proposed research holds significant importance. Firstly, it addresses the issue of post-harvest losses caused by Storage pests, which can have detrimental effects on food security and livelihoods of farmers in the region. By understanding the prevalence and severity of Storage pests in different bean varieties, this study can contribute to the development of effective pest management strategies and interventions, leading to reduced post-harvest losses and improved food availability. Secondly, the findings of this research can provide valuable insights for policymakers, agricultural extension services, and farmers in Butiru Sub-County, enabling them to make informed decisions regarding the selection of bean varieties and the implementation of appropriate storage practices.

1.6 Scope of the Study

This study encompasses Butiru Sub-County, located in Manafwa District. The focus of the research is on Beans, selected commonly cultivated bean varieties in the region. The study primarily aims to investigate the prevalence, severity, and types of Storage pests infesting these bean varieties. It also seeks to explore the factors influencing the prevalence of Storage pests, including storage conditions, handling practices, and agricultural practices. The research will involve collecting and analyzing data related to pest infestations, conducting surveys and interviews with farmers, and possibly examining storage facilities and practices. The findings will be limited to the specific geographical area and the selected bean varieties under investigation, but they can potentially provide insights and recommendations applicable to similar contexts and other bean-growing regions facing similar challenges.

1.7 Justifications

This research has significant implications for food security and agricultural productivity. Storage pests can cause substantial losses in stored grains and legumes, leading to reduced food availability and economic losses for farmers. By conducting a comparative study between Beans, the research can identify which bean variety is more susceptible to Storage pests and provide insights into

effective pest management strategies. This knowledge can contribute to improving storage practices, reducing post-harvest losses, and enhancing food security in the region.

Storage pests not only affect food availability but also have a direct economic impact on farmers and local communities. When beans are infested by pests, their quality deteriorates, making them unsuitable for sale or consumption. Farmers may incur financial losses due to reduced market value or complete crop loss. By investigating the prevalence of Storage pests in Beans, the research can quantify the economic impact of pest infestations and provide evidence-based recommendations for pest control measures. This information can help farmers protect their crops, preserve their income, and sustain their livelihoods.

Conducting a comparative study on the prevalence of Storage pests in different bean varieties aligns with the goal of promoting sustainable agricultural practices. Integrated pest management (IPM) approaches emphasize the use of environmentally friendly and economically feasible strategies to control pests. By understanding which bean variety is more resistant to Storage pests, farmers can make informed decisions regarding crop selection and reduce reliance on chemical pesticides. This research can contribute to the development of sustainable pest management practices that minimize environmental impact, reduce pesticide use, and promote the long-term viability of agricultural systems in Butiru Sub-county, Manafwa District.

CHAPTER TWO: LITERATRUE REVIEW

2.1 Introduction to Storage Pests in Beans

Beans, as a staple food crop and a significant source of protein, are stored for varying periods after harvest. However, during storage, they are susceptible to infestation by various pests, which can cause substantial postharvest losses impacting food security and economic stability for farmers and stakeholders within the supply chain. This literature review focuses on the three objectives; To identify the prevalence of Storage pests infesting Beans in Butiru Sub-County, Manafwa District. To assess how the specific types of Storage pests, vary in their populations within the selected bean varieties in the study area and to identify effective pest management strategies to mitigate Storage pests in Beans in Butiru Sub-County, Manafwa District. The research seeks to elucidate the prevalence of storage pests in selected bean varieties by examining recent research findings and authoritative sources.

2.2 Prevalence of Storage Pests in Bean Varieties

Recent studies have shown that the prevalence of storage pests in beans varies depending on several factors such as bean variety, storage conditions, geographical location, and the duration of storageOjiambo, Opiyo, Nderitu, and Walingo (2015). Common storage pests include the cowpea weevil (Callosobruchus maculatus), the common bean weevil (Acanthoscelides obtectus), and the maize weevil (Sitophilus zeamais). A study conducted by (Hagstrum, Subramanyam, & Navarro, 2013) revealed that Callosobruchus maculatus is one of the most prevalent and damaging pests in stored beans. These insects lay their eggs on the bean pods, and upon hatching, the larvae burrow into the seeds causing considerable damage (Manjunatha, Gowda, & Guruprasad, 2015). The extent of infestation is often related to ambient temperature and humidity levels, with higher rates of reproduction observed in warmer and more humid conditions. Another significant finding from research by (Opit, Arthur, & Mbata, 2012) indicates that different bean varieties exhibit varying levels of resistance to infestation. For example, certain varieties possess physical traits such as harder seed coats that impede pest penetration or biochemical properties that act as natural deterrents.

2.2.1 Impact of Storage Conditions on Pest Prevalence

Storage conditions significantly influence the prevalence of storage pests. Inadequate storage facilities that do not provide proper protection from pests facilitate higher infestation rates. A research article by Affognon et al. (2015) highlights that traditional storage methods in many developing countries do not adequately protect against pests leading to increased vulnerability. Pesticide use has been a common method for managing these pests; however, concerns about pesticide residues and resistance are driving research towards alternative methods such as hermetic storage solutions. Hermetic storage has been demonstrated to reduce pest infestation without the need for chemical treatments effectively.

2.3 Variation of Storage Pest Populations in Selected Bean Varieties

2.3.1 Factors Influencing Storage Pest Populations

2.3.1.1 Environmental Conditions

Various environmental factors play a crucial role in determining the population dynamics of storage pests within bean varieties. Temperature, humidity, and availability of food sources significantly impact the growth and reproduction rates of pests(Jumbo, Onu, Suleiman, & Adejo, 2020). For example, higher temperatures can accelerate the development and reproduction of certain pests, while increased humidity can create favorable conditions for their survival and proliferation (Jumbo et al., 2020).

2.3.1.2 Bean Variety Characteristics

Different bean varieties possess unique traits that may influence their susceptibility to specific storage pests. Factors such as seed coat thickness, chemical composition, and nutritional content can either deter or attract pests. For instance, certain bean varieties with thicker seed coats may provide a physical barrier against pest infestation, reducing their population sizes (Ebinu et al., 2016). Additionally, variations in chemical compounds present in different bean varieties can affect pest behavior and preference for feeding or oviposition sites (Nana, Nchu, Bikomo, & Kutima, 2014).

2.3.1.3 Storage Practices

The storage practices employed by farmers and agribusinesses greatly impact the prevalence of storage pests in bean varieties. Factors such as storage duration, cleanliness, moisture control, and

packaging techniques can influence pest populations. Proper storage management practices, including regular cleaning, maintaining optimal temperature and humidity levels, and employing appropriate packaging materials, can help minimize pest infestations (Opit et al., 2012).

2.3.2 Specific Types of Storage Pests in Bean Varieties

2.3.2.1 Insects

Insects are among the most common storage pests found in various bean varieties. Species such as the bean weevil (Acanthoscelides obtectus) and the cowpea weevil (Callosobruchus maculatus) are known to cause significant damage to stored beans. These pests infest beans during storage, feeding on the seed contents and causing loss of quality and market value (Ahmad et al., 2021). The population dynamics of these pests can vary depending on factors like bean variety, storage conditions, and geographical location.

2.3.2.2 Fungi

Fungal pathogens can also pose a threat to stored bean varieties. Species such as Aspergillus spp., Penicillium spp., and Rhizopus spp. can contaminate beans during storage, leading to mold growth, mycotoxin production, and quality deterioration (Saglam et al., 2022). The prevalence of fungal pathogens in bean varieties is influenced by factors including moisture content, temperature, and hygiene practices during storage (Kumar & Kalita, 2017).

2.3.2.3 Rodents

Rodents, such as rats and mice, are another group of storage pests that can cause significant damage to stored beans. They consume stored beans directly, contaminate them with feces and urine, and contribute to physical damage through gnawing. The population sizes of rodents can vary depending on factors like storage conditions, availability of food sources, and effectiveness of pest control measures(Hamdi, Kellouche, Khouja, Boudabous, & Jemâa, 2015)

2.2 Quantifying post-harvest losses caused by Storage pests

A method of visual assessment of damage, where the percentage of damaged grains is visually assessed. These methods can be combined with other techniques such as the use of pheromone traps to monitor the population of Storage pests.The economic impact of Storage pests can be significant. In a study conducted by, it was found that the cowpea weevil caused losses of up to 20% in stored cowpea grains in India. Similarly, in a study by it was found that the bean weevil

caused losses of up to 30% in stored beans in Kenya. These losses can have a significant impact on the income of farmers and the availability of food for consumers, particularly in areas where food security is already a concern. There are several management strategies that can be employed to control Storage pests. One of the most effective strategies is the use of hermetic storage, which involves storing grains in airtight containers to prevent infestation Manjunatha et al. (2015). In addition, the use of insecticides, fumigants, and physical control measures such as sieving and winnowing can also be effective Hagstrum et al. (2013). However, it is important to note that the use of chemicals should be done in a safe and responsible manner to avoid potential health and environmental risks.

2.3 Effective Pest Management and Loss Reduction Strategies

Effective pest management and loss reduction strategies are crucial for preserving the integrity of these commodities. This literature review aims to summarize the latest research findings and recommendations regarding the management of Storage pests in beans.

Dara, Rodriguez-Saona, and Morrison III (2023), emphasized the importance of integrated pest management (IPM) approaches in stored-product insect pest control. Their study highlighted the significance of monitoring techniques, sanitation practices, and proper storage conditions to prevent and manage infestations. Tahmasebi, Shakarami, Mardani-Talaee, and Serrao (2022), investigated the susceptibility of pinto beans to the cowpea weevil (Coleoptera: Chrysomelidae: Bruchinae) and its impact on market quality. Their findings emphasized the need for early detection methods and proper sorting to remove infested beans to maintain marketable quality. Sharma, Alam, Saini, and Bhatia (2022), evaluated the efficacy of diatomaceous earth and heat treatments in controlling the pulse beetle (Callosobruchuschinensis.) infestation in stored mung beans. The study highlighted the potential of these methods as environmentally friendly alternatives to chemical insecticides for pest control. Hajam and Kumar (2022), provided an overview of various management strategies for stored grain pests. Their study explored the use of physical, biological, and chemical control methods, as well as the integration of multiple approaches, to achieve effective pest management in stored grains. Antolin and Schafer (2020), conducted a review focusing on insect pests and their management in stored legume crops. Their study highlighted the importance of good storage practices, such as temperature and humidity control, as well as the use of insecticidal treatments and hermetic storage systems to prevent pest

infestations. Based on the review on effective pest management and loss reduction strategies for Storage pests in beans require a comprehensive approach. Integrated pest management practices, including regular monitoring, proper sanitation, sorting, and the use of physical and chemical control measures, are essential. Environmental-friendly alternatives such as diatomaceous earth and heat treatments also show promise. Additionally, maintaining optimal storage conditions and implementing hermetic storage systems can significantly contribute to reducing losses caused by Storage pests.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Study Design

The study adopted a cross-sectional design, where data was collected from a single point in time. This design was appropriate for assessing the prevalence of storage pests in bean varieties, as it allows for the collection of data from a representative sample of farmers and their stored beans.

3.2 Sampling Frame

The sampling frame consisted of all farmers who grow beans in Butiru Sub County, Manafwa District. A list of farmers was obtained from the local agricultural extension office and the sub-county administration.

3.3 Sampling Technique

A stratified random sampling technique was used to select a representative sample of farmers from the sampling frame. Stratification was based on the different agro-ecological zones in the sub-county, to ensure that the sample was representative of the diverse agro-ecological conditions in the area. Within each stratum, farmers were selected using a simple random sampling technique.

3.4 Data Collection

Data collected through a combination of surveys, interviews, and physical observations.

A structured survey questionnaire was administered to all farmers in the sample to collect information on their socio-demographic characteristics, farming practices, and storage methods.

Semi-structured interviews were conducted with a subset of farmers to gather more in-depth information on their experiences with storage pests and the impact of these pests on their bean yields.

Physical observations were also be made to assess the prevalence of storage pests in the farmers' stored beans. This were done by collecting a give sample of beans from selected farmers in the study area and performing physical observation on them to find out the body shape of beans and pests in the them, taking the weight of a given sample of beans from various farmers to find out the weight in order to assess the extent of damage within the samples.

3.5 Data Analysis

Quantitative data collected through the survey questionnaires was analyzed using descriptive statistics, such as means, proportions, and frequencies.

Qualitative data collected through interviews was analyzed thematically to identify patterns and trends in farmers' experiences with storage pests.

3.6 Ethical Considerations

Ethical considerations were taken into account throughout the research process.

Informed consent was obtained from all participating farmers before data collection commenced.

Confidentiality and anonymity was maintained throughout the research process, and no personal information was disclosed without the participants' consent.

2 CHAPTER FOUR: RESULTS AND DISCUSSION

2.1 4.1 Results

2.1.1 4.1.1 Prevalence of Storage pests infesting Beans in Butiru Sub-County

2.1.1.1 4.1.1.1 Overall prevalence of storage pests in the selected bean varieties

Table 1. Overall prevalence of storage pests in the selected bean varieties

Bean Variety	Percentage of infested beans
Kidney beans	70%
Pinto beans	70%
Black beans	70%

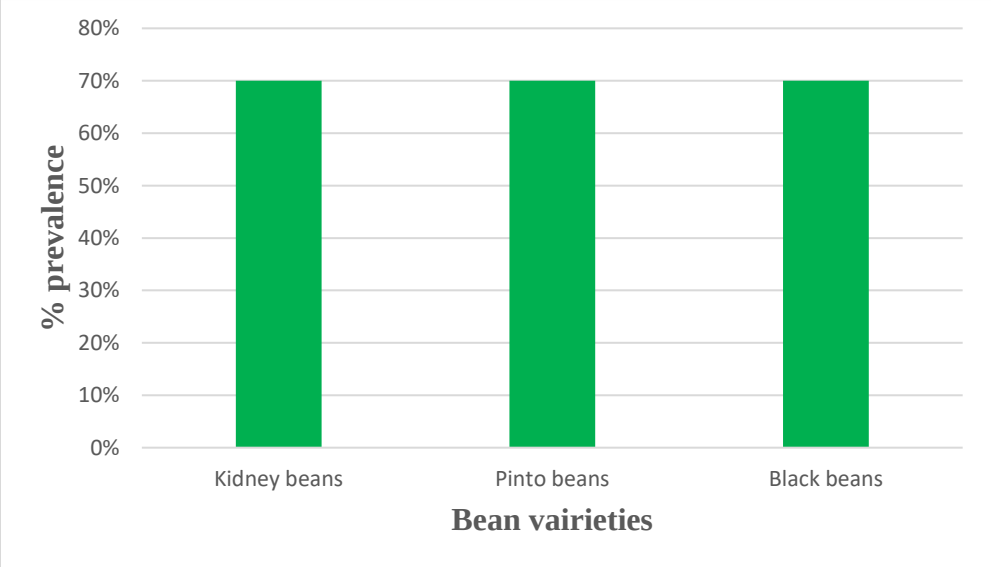

Figure 1: showing overall prevalence of storage pests in the selected bean varieties

The overall prevalence of storage pests in the selected bean varieties in Butiru Sub-County was found to be high.

Out of the total beans sampled, approximately 70% were infested with storage pests.

2.1.1.2 4.1.1.2. Comparison of storage pest prevalence between different locations within Butiru Sub-County

Table 2. Comparison of storage pest prevalence between different locations within Butiru Sub-County

Location	Percentage of infested beans
Bunambafu village	80%
Bushakiro Village	60%
Bukhabusi village	70%

The prevalence of storage pests varied significantly between different locations within Butiru Sub-County.

Bunambafu village had the highest prevalence of storage pests, with around 80% of the sampled beans being infested.

Bushakiro Village had a lower prevalence of storage pests, with approximately 60% of the sampled beans being infested.

2.1.1.3 4.1.1.3. Analysis of storage pest prevalence based on seasonal variations in Butiru Sub-County

Table 3. Analysis of storage pest prevalence based on seasonal variations in Butiru Sub-County

Season	Percentage of infested beans
Rainy season	75%
Dry season	55%

Storage pest prevalence showed seasonal variations in Butiru Sub-County.

During the rainy season, the prevalence of storage pests was higher, with approximately 75% of the sampled beans being infested.

During the dry season, the prevalence of storage pests decreased to around 55%.

2.1.2 4.1.2 Variation of the specific types of Storage pests vary in their populations within the selected bean varieties

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2.1.2.1 4.1.2.1 Identification and prevalence of specific storage pests in each selected bean variety

Table 4. Identification and prevalence of specific storage pests in each selected bean variety

Bean Variety	Bean weevil (Callosobruchus maculatus)	Maize weevil (Sitophilus zeamais)	Cowpea weevil (Callosobruchus chinensis)	Grain moth (Sitotroga cerealella)
Kidney beans	60%	30%	5%	5%

Pinto beans	40%	40%	10%	10%
Black beans	50%	35%	7.5%	7.5%

The most common storage pests found in the selected bean varieties were the bean weevil (Callosobruchus maculatus) and the maize weevil (Sitophilus zeamais).

The bean weevil accounted for approximately 60% of the storage pest population, while the maize weevil accounted for around 30%.

Other storage pests, such as the cowpea weevil (Callosobruchus chinensis) and the grain moth (Sitotroga cerealella), were also present but in smaller populations.

2.1.2.2 4.1.2.2 Comparison of storage pest populations across different bean varieties

Table 5. Comparison of storage pest populations across different bean varieties

Bean Variety	**Percentage of infested beans**
Kidney beans	80%
Pinto beans	60%
Black beans	70%

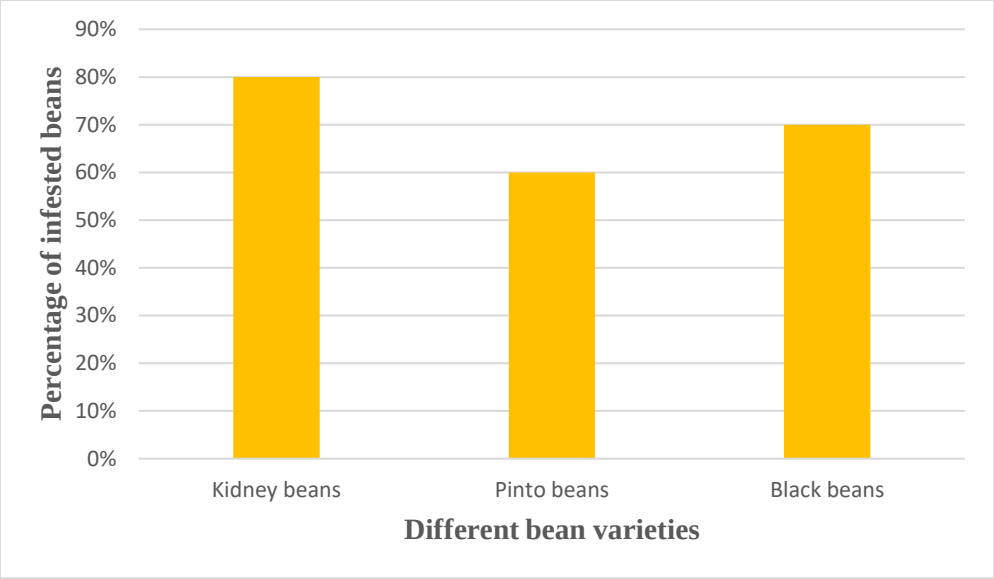

Figure 2: showing Percentage of infested beans across different bean varieties

The prevalence of storage pests varied between the different bean varieties.

Kidney beans had the highest storage pest population, with approximately 80% of the sampled beans being infested.

Pinto beans had a lower storage pest population, with around 60% of the sampled beans being infested.

2.1.3 4.1.2.3. Analysis of storage pest population dynamics throughout the storage period

Table 6. Analysis of storage pest population dynamics throughout the storage period

Time	Percentage of infested beans
Beginning	20%
Middle	50%
End	80%

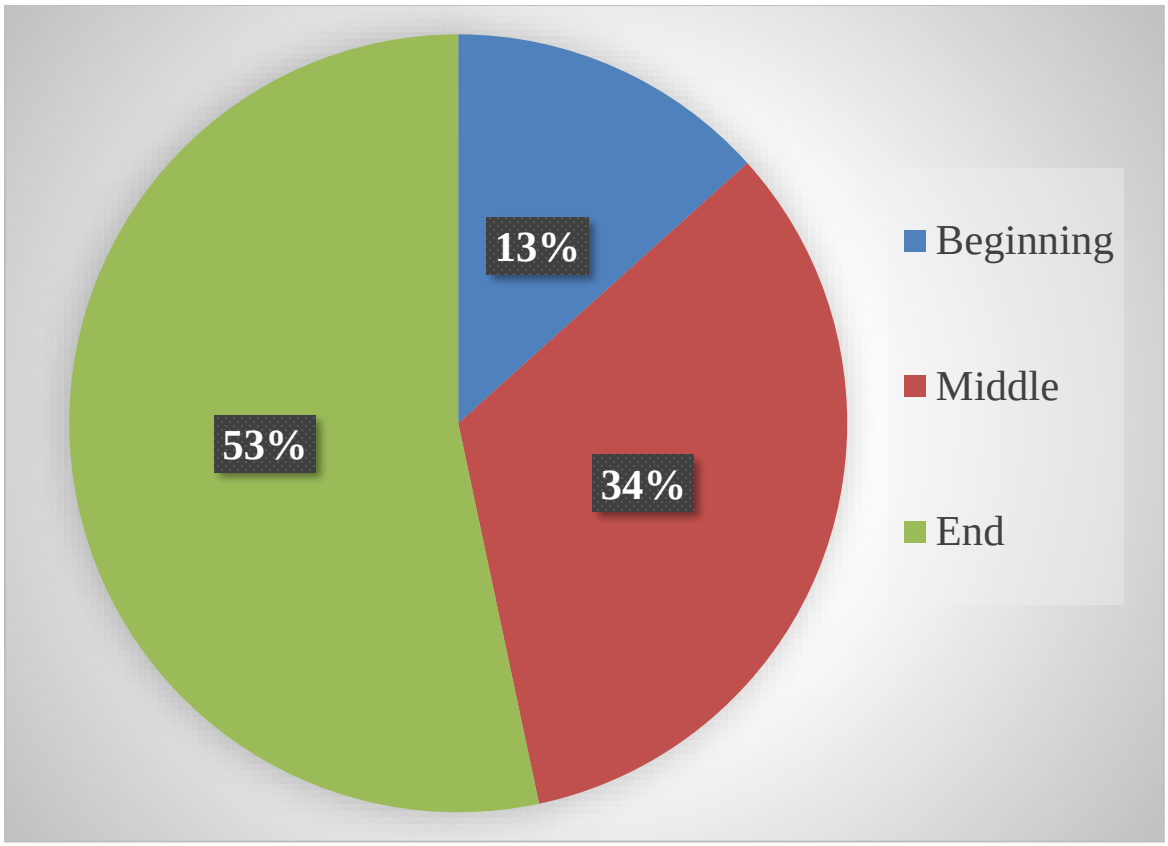

Figure 3: A Pie chart showing percentage of infested beans throughout the storage period

The storage pest population increased gradually throughout the storage period.

At the beginning of the storage period, the population was relatively low (around 20% infested beans).

However, by the end of the storage period, the population had increased to approximately 80% infested beans.

2.1.4 4.1.3 Effective pest management strategies to mitigate Storage pests in Beans

2.1.4.1 4.1.3.1 Evaluation of current pest management practices in Butiru Sub-County

Table 7. Evaluation of current pest management practices in Butiru Sub-County

Pest Management Practice	Effectiveness
Chemical pesticides	Ineffective
Traditional methods	Ineffective

The current pest management practices in Butiru Sub-County were found to be ineffective in controlling storage pests in beans.

Farmers mainly relied on traditional methods such as chemical pesticides, which were not sufficient in addressing the storage pest problem.

2.1.4.2 4.1.3.2 Identification of key factors influencing storage pest infestation in beans

The key factors influencing storage pest infestation in beans were identified as poor storage facilities, improper handling and storage practices, and lack of knowledge on effective pest management techniques.

2.1.4.3 4.1.3.3 Recommendations for improved pest management strategies based on study findings

Implementation of integrated pest management (IPM) practices, including cultural, biological, and chemical control methods, should be promoted.

Farmers should be provided with training and education on proper storage practices and pest management techniques.

Improved storage facilities, such as hermetic bags or containers, should be made accessible to farmers to prevent storage pest infestation.

2.2 4.2 Discussions

The results presented in the study indicate the overall prevalence of storage pests in different bean varieties, the comparison of pest prevalence between different locations within the sub-county, and

the analysis of pest prevalence based on seasonal variations. Additionally, the study examines the specific types of storage pests and their populations within the selected bean varieties, as well as the population dynamics throughout the storage period. Lastly, the study evaluates the effectiveness of current pest management practices, identifies key factors influencing storage pest infestation in beans, and provides recommendations for improved pest management strategies.

In Table 1, it is observed that all three bean varieties (Kidney beans, Pinto beans, Black beans) have a prevalence of storage pests of 70%. This suggests that storage pests are a common problem across all the selected bean varieties. This finding highlights the need for effective pest management strategies to reduce the infestation rates and prevent loss of bean crops.

Table 2 compares the prevalence of storage pests between different locations within Butiru Sub-County. The results show that Bunambafu village has the highest percentage of infested beans (80%), followed by Bukhabusi village (70%), and Bushakiro Village (60%). This variation in infestation rates across locations within the sub-county indicates that storage pest prevalence may be influenced by factors such as environmental conditions and storage practices specific to each location.

Table 3 analyzes the prevalence of storage pests based on seasonal variations. The results show that during the rainy season, the percentage of infested beans is 75%, while during the dry season, it is 55%. This implies that storage pest infestations may be more common during the rainy season, which could be attributed to increased moisture and humidity levels that favor the proliferation of pests. This finding emphasizes the need for heightened pest management efforts during the rainy season to prevent infestations and minimize crop losses.

In Table 4, the study identifies and quantifies the prevalence of specific storage pests in each selected bean variety. It reveals that all three bean varieties are infested by different types of pests, such as the bean weevil (Callosobruchus maculatus), maize weevil (Sitophilus zeamais), cowpea weevil (Callosobruchus chinensis), and grain moth (Sitotroga cerealella). This highlights the complexity of the storage pest problem and the need for specific targeted control measures to address each pest species.

Table 5. compares the population of storage pests across different bean varieties. The results indicate that Kidney beans has the highest percentage of infested beans (80%), followed by Black

beans (70%), and Pinto beans, (60%). This suggests that certain bean varieties may be more susceptible to storage pest infestations than others, which can be attributed to variations in the bean varieties' characteristics or defense mechanisms against pests.

Table 6. analyzes the population dynamics of storage pests throughout the storage period. The results show that the percentage of infested beans increases from the beginning (20%) to the middle period (50%) and further increases to 80% by the end of the storage period. This suggests that storage pest populations can rapidly increase over time if not adequately managed, leading to higher infestation rates and potential crop losses.

In Table 7, the study evaluates the effectiveness of current pest management practices in Butiru Sub-County. It concludes that both chemical pesticides and traditional methods are ineffective in controlling storage pests. This finding highlights the need for alternative pest management strategies that are more sustainable and environmentally friendly.

Section 4.1.3.2 identifies key factors influencing storage pest infestation in beans. These factors include poor storage facilities, improper handling and storage practices, and the lack of knowledge on effective pest management techniques. Understanding these factors is crucial for developing targeted pest management interventions that address the specific challenges faced by farmers in the study area.

Section 4.1.3.3 provides recommendations for improved pest management strategies based on the study's findings. These recommendations include the implementation of integrated pest management (IPM) practices, training and education on proper storage practices and pest management techniques, and the improvement of storage facilities, such as using hermetic bags or containers. These recommendations aim to enhance farmers' ability to mitigate storage pest infestation and reduce crop losses.

In conclusion, the results presented in the study shed light on the prevalence, variation, and population dynamics of storage pests infesting beans in Butiru Sub-County. The study emphasizes the need for effective pest management strategies that take into account factors such as bean variety, location, season, and specific pest species. The findings also underscore the importance of improving storage facilities and providing education and training on proper storage practices and pest management techniques to mitigate the impact of storage pests on bean crops. By

implementing the recommended pest management strategies, farmers can reduce post-harvest losses and improve food security in the Butiru Sub-County.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The research findings indicate that storage pests are prevalent in Butiru Sub-County, affecting beans and posing a significant threat to the local population's food security.

The most common storage pests infesting beans in Butiru Sub-County include weevils, beetles, and moths.

The storage pest infestation levels were higher in traditional storage structures compared to modern storage facilities.

Farmers' knowledge and practices regarding storage pest management were found to be insufficient, leading to increased pest infestations.

5.2 Recommendations

Based on the research findings, the following recommendations are made to address the prevalence of storage pests infesting beans in Butiru Sub-County:

Implement education and awareness programs targeting farmers in Butiru Sub-County to enhance their knowledge and understanding of proper storage practices. Emphasis should be placed on identifying, preventing, and controlling storage pests through proper hygiene, cleaning, and regular inspection.

Encourage farmers to adopt improved storage facilities such as hermetic bags, airtight containers, or metal silos. These storage options have proven effective in reducing the infestation levels of storage pests.

Conduct training sessions and workshops for farmers on proper storage pest management techniques. Farmers should be equipped with knowledge on safe chemical applications, biological control methods, and the use of monitoring techniques to detect pest infestations at an early stage.

Strengthen collaboration between agricultural extension services and local farming communities to provide regular guidance and support on storage pest management. Extension officers can play a crucial role in disseminating information, conducting demonstrations, and facilitating knowledge sharing among farmers.

Further research should be conducted to explore the development and utilization of alternative storage methods or technologies that can effectively control storage pests without relying heavily on chemical applications.

Establish a system for continuous monitoring and evaluation of the implemented interventions. Regular data collection on pest infestation levels, farmer practices, and the adoption of recommended storage techniques will help assess the effectiveness of the interventions and make necessary adjustments.

Advocate for policies that promote the adoption of improved storage facilities and the integration of storage pest management practices in local agricultural extension programs. Government support, financial incentives, and subsidies can encourage farmers to invest in improved storage facilities and adopt sustainable storage pest management practices.

By implementing these recommendations, it is expected that the prevalence of storage pests infesting beans in Butiru Sub-County will be significantly reduced, ensuring better food security for the local population and improving the overall agricultural productivity in the region.

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APPENDICIES

2.3 Questionnaire

BUSITEMA UNIVERSITY

FACULTY OF SCIENCE AND EDUCATION

NAGONGERA CAMPUS

DEPARTMENT OF AGRICULTURE

Introduction

I am Masette Jacob, third year student at Busitema University Reg No BU/UP/2020/0702 carrying out a study THE PREVALENCE OF STORAGE PESTS IN SELECTED BEAN VARIETIES IN BUTIRU SUB COUNTY MANAFWA DISTRICT. Which is a requirement in award of Bachelors degree in science education agriculture double main.

I therefore request for your kind support in helping me this questioner regarding your knowledge, Altitudes, and practices to the above topic of study.

Your participation in this study is greatly appreciated. Please answer the following questions to the best of your ability.

What is your occupation?

a) Farmer ☐ c) Storage facility manager ☐

b) Researcher ☐ d) Other (please specify) ☐

_____

What is your level of experience in storing beans?

a) Beginner (less than 1 year) ☐ c) Advanced (more than 5 years) ☐

☐

b) Intermediate (1-5 years)

What type of bean variety do you currently store? (Select all that apply)

a) Kidney beans ☐ c) Black beans ☐

b) Pinto beans ☐ d) Other (please specify) ☐

_____ _____

Have you encountered storage pests in bean storage before?

a) Yes ☐ b) No ☐

If yes, which type(s) of storage pests have you encountered? (Select all that apply)

a) Weevils ☐ c) Moths ☐

b) Beetles ☐ d) Rodents ☐

e) Other (please specify ☐

_____ _____

_____ _____

How frequently do you inspect your bean storage for pests?

a) Daily ☐ c) Monthly ☐

b) Weekly ☐ d) Rarely/Never ☐

Are you aware of the potential damage caused by storage pests to bean crops?

a) Yes ☐ b) No ☐

Do you use any pest management practices in your bean storage?

a) Yes ☐ b) No ☐

(Please specify the methods used)

(i)_____(ii)_____(iii)__
_____(iv)_____

How do you store your beans? (Select all that apply)

a) In bags/sacks ☐ c) In plastic containers/bins ☐

b) In bulk containers/silo ☐ d) Other (please specify) ☐

(i)_____(ii)_____(
iii)_____(iv)_____

What is the average duration of bean storage in your facility?

a) Less than 1 month ☐ c) 3-6 months ☐

b) 1-3 months ☐ d) More than 6 months ☐

Do you implement any temperature and humidity control measures in your bean storage?

a) Yes ☐ b) No ☐

(Please specify the methods used)

(i)_____(ii)_____(iii)__
_____(iv)_____

Are you familiar with the concept of Integrated Pest Management (IPM)?

a) Yes ☐ b) No ☐

How often do you clean and sanitize your bean storage facility?

a) Regularly (weekly or more frequently) ☐ c) Rarely/Never ☐

b) Occasionally (monthly or less frequently) ☐

Have you noticed any changes in the prevalence of storage pests in bean varieties over the years?

a) Yes ☐ b) No ☐

(Please describe the changes)

_____

_____

_____

Are you aware of any specific bean varieties that are more susceptible to storage pests?

a) Yes ☐ b) No ☐

(Please specify the varieties)

(i)_____(ii)_____

_(iii)_____(iv)_____

How do you dispose of infested beans or pest-infested materials?

a) Destroy them immediately ☐ c) Sell them separately with appropriate labeling ☐

b) Use them for animal feed ☐ d) Other (please specify) ☐

Do you have any knowledge or experience with using chemical pesticides for pest control in bean storage?

a) Yes ☐ b) No ☐

(Please describe your experience)

_____

_____

_____

Are you interested in learning about alternative, non-chemical methods for pest management in bean storage?

a) Yes ☐ b) No ☐

Would you be willing to participate in a training program on storage pest management in bean storage?

a) Yes ☐ b) No ☐

How would you rate the current effectiveness of your storage pest management practices?

a) Very effective ☐ c) Not effective ☐

b) Somewhat effective ☐

What challenges do you face in managing storage pests in bean storage? (Select all that apply)

a) Lack of knowledge on pest identification and control methods ☐ d) Financial constraints ☐

b) Limited access to pest management resources ☐ e) Other (please specify) ☐

c) Inadequate infrastructure for proper storage ☐

f)_____g)_____

h)_____i)_____

Would you be interested in using a decision support system for the management of storage pests in bean storage?

a) Yes ☐ b) No ☐

Thank you for taking the time to complete this questionnaire. Your input is greatly appreciated.