

MAKERERE



UNIVERSITY

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

SCHOOL OF AGRICULTURAL SCIENCES

**POST-HARVEST HANDLING PRACTICES AND EFFECT ON MARKET
PERFORMANCE: A CASE OF ONION TRADERS IN KAMPALA**

BY

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**A SPECIAL RESEARCH PROJECT REPORT SUBMITTED TO THE
DEPARTMENT OF AGRIBUSINESS AND NATURAL RESOURCE ECONOMICS
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF
THE DEGREE BACHELOR OF AGRIBUSINESS MANAGEMENT OF MAKERERE
UNIVERSITY.**

AUGUST 2025

DECLARATION AND APPROVAL

I Nyesiga Osbert, hereby declare that this research report "Post-Harvest Handling Practices and Effect on Market Performance: A Case of Onion Traders in Kamapla" is my own original work and has never been submitted for any award to any institution of higher learning. However, the works by other scholars have been cited and referenced.

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DEDICATION

To my family and friends whose support and encouragement have been very instrumental in my academic journey.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Alex Tatwangire, for his guidance and support during the research process. I also extend my sincere appreciation to the onion traders in Kasubi and Kalerwe markets for their participation in this study.

In a special way, I thank my parents Mr. Muhangi David and Mrs. Atuheire Abiya for their love, encouragement and support during my academic journey.

I thank the Almighty God for the gift of life and unending providence.

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ABSTRACT

This study investigated post-harvest handling practices and their effect on market performance among onion traders operating in Kalerwe and Kasubi markets of Kampala, Uganda. The study addresses a critical gap in understanding how these selected practices influence market performance outcomes in the onion subsector. A cross-sectional survey was conducted from June to August 2025, involving 102 onion traders comprising 72 retailers and 30 wholesalers. Data were collected using structured questionnaire capturing demographic variables, adoption of recommended post-harvest practices (and market performance metrics in form of sales volume, value addition, and profit margins). The recommended post-harvest practices included: sorting and grading, packaging, transporting, and storage. Descriptive statistics and Ordinary Least Squares (OLS) regression were employed to analyse the data. The study findings show that storage practices among retailers were universally adopted at almost 100%. The sorting and grading are most prevalent among divorced retail traders at 87.5% and those traders aged 31–35 years at 75.9%. Packaging and transporting showed lower adoption, particularly among retailers identified as single at 44.4% and those with primary education at 40.0%. Wholesalers demonstrated near-universal adoption of packaging, transporting, and storage at 100%, while the adoption of sorting and grading is highest (100%) among younger traders aged 20–25 years. Retailers recorded an average annual sales volume of 8,342 kg and an annual profit margin of Ugx. 4.9 million, with packaging linked to the highest annual sales (8,591.9 kg). Wholesalers achieved significantly higher quantity of sales of 41,901.3 kg and corresponding gross profits of 22.5 million UGX with consistent performance across practices. Findings from Ordinary Least Square (OLS) regression indicated non-significant effects of post-harvest practices on sales and profits for both groups, with sorting showing a slight positive effect ($r = 0.2$ for wholesalers, $P = 0.317$). These findings suggest that post-harvest practices are widely adopted, their impact on market performance of onion is positive but insignificant limited, a phenomenon that can be attributed to Market conduct of traders, who prefer dealing small quantities that can sell in a short period, and therefore necessitating a limited need to store. The lack of appropriate infrastructure could also be limiting quantities that wholesalers can procure and distribute in the markets. Targeted capacity building interventions are needed to enhance the adoption of these selected practices in the short run, and also to evaluate the kind of storage infrastructure that traders find appropriate for them to increase the amount of onions stored and therefore enhance market performance in the long run.

CHAPTER ONE

INTRODUCTION

1.1 Background

The high perishability of onions undermines their importance in the diets of humans (Rees et al., 2012). Onions are a crucial source of minerals and vitamins and they are widely consumed globally (Bahram-Parvar & Lim, 2018; Bulama et al., 2024). Despite the significant economic benefits of onion production, post-harvest damages to onions cause high economic losses to onion producers and sellers (Bello & Yakubu, 2023). Globally, 20-30% of onion harvests worldwide are being lost after harvesting due to improper handling, storage, and transportation (Blessing, 2024).

Onions are the most consumed vegetable globally and is suggested to have originated from the southwest Asia (Jo et al., 2020). The top producers of onion across the globe are China, India, USA, Iran, Egypt, Turkey, Brazil, Pakistan, the Republic of Korea, and the Russian Federation. In East Africa, Uganda is the leading onion producer and contributes 47% of onions produced and 41% consumed in East Africa region followed by Tanzania, while Kenya and Rwanda's production is even below consumption level (Joachim, 2018; Pareek et al., 2017).

Despite the significant economic post-harvesting losses associated with reduced quality of onions (Bulama et al., 2024; Falola et al., 2023), few studies have been conducted on the linkages between use of post-harvest practices, drivers of post-harvest damages on onions and market performance, especially in Uganda. There is limited evidence on the extent to which selected post-harvest practices are utilised among onion traders and how varying levels of use is correlated to market performance of onion traders in major city markets in Uganda. It is important provide insights on how use of post-harvest practices helps to minimise economic losses, extend shelf-life, improve quality and enhance market performance of onion traders in Uganda's urban markets.

In Uganda, various onion species are grown including Jamba, Red Creole, Red cornet, Red Bombay, Afri seed, Red Pinoy, Red snack Pearl, Red passion, and Texas Grano. These species of onions are commonly grown mainly in the district of Rakai, Kigezi, Mbale, Sironko, Tororo, and Mbarara. Onion production in Uganda occupies 3,700 hectares (ha)

with an estimated yield of 147,000 metric tons per hectare (Munezero et al., 2023; Pesanayi et al., 2020).

In Uganda, onions are grown as a major source of income and are among the top vegetables mostly consumed in Uganda. The production of onion in Uganda however faces several challenges including limited access to post-handling information and technologies, losses to pests and limited access to good post-harvest handling practices. Losses in onion production and post-harvest have been attributed to environmental challenges, the handling methods employed, and marketing challenges (Munezero et al., 2023; Pesanayi et al., 2020).

In post-harvest handling of onions, proper sorting, grading, cleaning, and packaging are critical steps to reduce onion losses. Sorting and grading allow farmers to remove damaged or diseased bulbs, while cleaning ensures the removal of soil and debris that can harbor pests. Packaging in ventilated bags or crates can help reduce mechanical damage and allow better air circulation during storage and transport (Blessing, 2024; Munezero et al., 2023).

Poor post-harvest handling practices of onions by traders have been reported to lead to onion damage and losses (Falola et al., 2023). However, there is limited knowledge regarding the post-harvest handling practices of onion traders and their implications to ultimate market performance of onions especially in developing countries including Uganda. Therefore, this study aims to characterize the post-harvest practices of onion traders according to the recommended practices and the effect on market performance of onions in selected markets in Kampala, Uganda. The findings of this study will guide formulation of target interventions to prolong the shelf life of onions and minimise the economic losses.

1.3 Study Objectives

1.3.1 General objective

To assess the post-harvest handling practices of onion traders and effect on the market performance of onions in in Kampala city, Uganda.

1.3.2 Specific objectives

1. Characterise onion traders in Kampala city markets based on the use of recommended post-harvest practices that reduce losses and enhance onion market performance.

2. Assess the level of market performance of onions across onion traders in Kampala city market.
3. Assess the effect of post-harvest handling practices on market performance of onions among onion traders in Kampala city market

1.5 Hypotheses

1. Market performance (sales, value addition, and profit margin) is low among onion traders in Kampala market.
2. Participating in each of the selected post-harvest handling practices does not increase market performance across onion traders in Kampala market.

1.6 Justification and Significance

This study is justified by the high post-harvest losses of onions in Uganda, largely resulting from poor handling, storage, and marketing practices among traders, yet little is known about how these practices affect onion quality and market performance. The significance of the study lies in generating empirical evidence that will inform traders, policymakers, and extension agents on effective interventions to enhance post-harvest handling, reduce economic losses, improve onion shelf life, and ultimately boost market performance, household incomes, and national food security.

CHPATER TWO

LITERATURE REVIEW

2.1 Overview

Onions (*Allium cepa* L.) are a critical horticultural crop globally, valued for their culinary versatility and economic significance in agricultural markets. In Uganda, onions are a staple commodity in urban markets such as Kalerwe and Kasubi in Kampala, contributing to food security and livelihoods. However, post-harvest losses and suboptimal handling practices significantly undermine onion quality and market performance, affecting traders' profitability and consumer satisfaction.

2.2 Post-Harvest Losses in Onions at a Global Scale

Onion post-harvest losses are a significant global issue, with approximately 20-30% of onion harvests worldwide being lost after harvesting due to improper handling, storage, and transportation (Kiran et al., 2024; Vitnor et al., 2020). These losses are particularly high in developing countries, where infrastructural deficits and inadequate storage facilities exacerbate the problem. Various studies across different onion-producing regions such as India, China, and the European Union highlight the impact of post-harvest losses on both food security and farmer incomes (Gubb & MacTavish, 2002; Zheng et al., 2001). In some countries, onion post-harvest losses have been estimated at up to 40%, reflecting the need for improvement in post-harvest management practices (Falola et al., 2023).

A comparative analysis of onion post-harvest practices reveals significant variations between countries. In developed nations, the use of modern storage technologies like cold storage and controlled atmosphere facilities helps reduce losses. In contrast, developing countries often rely on traditional storage methods, leading to high losses due to factors such as temperature fluctuations, pests, and inadequate ventilation (Falola et al., 2023; Gubb & MacTavish, 2002; Kiran et al., 2024; Sahu et al., 2025; Zheng et al., 2001). This disparity highlights the importance of addressing post-harvest losses in developing countries through the adoption of appropriate technologies and practices.

2.3 Post-Harvest Losses in onions in Uganda

In Uganda, post-harvest losses of agricultural produce, including onions, are a major challenge. However, there is no estimate of the exact quantity of onions losses annually. Losses of up to 25% have been reported in onions in addition to the low production in Uganda (Ddamulira et al., 2019; Munezero et al., 2023).

2.4 Factors influencing onion loss in Uganda

Several scholars have reported factors that influence post-harvest onion losses. Blessing (2024) reported unpredictable weather patterns, including rainfall during harvest and high humidity, contribute to the spoilage of onions (Blessing, 2024). Others have reported poor roads, lack of refrigeration, and limited access to modern storage facilities significantly increase post-harvest losses (Blessing, 2024; Ddamulira et al., 2019; Joachim, 2018; Munezero et al., 2023). In addition, farmers often lack proper training in sorting, grading, and handling practices, leading to mechanical damage and premature deterioration of onions (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020). Limited market access and inefficiencies in the supply chain result in delayed sales, increasing the risk of spoilage (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020).

2.5 Recommended post-Harvest Management of onions

Proper sorting, grading, cleaning, and packaging are critical steps to reduce onion losses. Sorting and grading allow farmers to remove damaged or diseased bulbs, while cleaning ensures the removal of soil and debris that can harbor pests. Packaging in ventilated bags or crates can help reduce mechanical damage and allow better air circulation during storage and transport (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020).

Traditional storage methods, such as open-air drying and pit storage, are commonly used in Ethiopia. However, these techniques expose onions to pests, humidity, and temperature fluctuations, leading to higher losses. Modern storage techniques, including ventilated storage rooms and refrigerated containers, provide better control over environmental conditions, extending shelf life and reducing spoilage (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020).

2.6 Post-Harvest Loss Reduction Strategies

Several strategies have been identified globally and in Ethiopia to reduce post-harvest losses in onions: Cold storage, ventilated storage, and controlled atmosphere storage facilities have been shown to significantly reduce post-harvest losses by maintaining optimal temperature and humidity levels. In Ethiopia, however, the widespread adoption of these technologies is hindered by high costs and limited access to such infrastructure. Efforts to subsidize these technologies or promote community-based storage facilities could provide viable solutions (Blessing, 2024; Munezero et al., 2023; Pareek et al., 2017).

Effective pre-harvest management practices, such as proper irrigation, pest control, and crop rotation, can help reduce post-harvest losses by ensuring the health and quality of the crop at harvest time. By addressing these issues early, the quality of onions at the time of harvesting can be improved, thereby minimizing losses during handling and storage (Blessing, 2024; Munezero et al., 2023; Pareek et al., 2017).

Emerging technologies, such as mobile applications for market information, solar-powered drying systems, and improved packaging materials, offer significant potential for reducing post-harvest losses. These technologies can help farmers make informed decisions, access better markets, and improve the quality and longevity of their produce (Blessing, 2024; Munezero et al., 2023; Pareek et al., 2017).

Inefficient transportation, often involving rough handling and long travel distances, contributes to onion losses. Improving road infrastructure and providing farmers with access to better packaging materials and transport options can help reduce these losses (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020).

Inadequate market linkages often result in delayed sales and poor price realization, further contributing to losses. Strengthening market access through better transportation networks, improved packaging, and better market information systems could reduce losses and increase farmers' income (Blessing, 2024; Ddamulira et al., 2019; Pareek et al., 2017; Pesanayi et al., 2020).

2.7 Market Performance of onions

Market performance in the context of onion trading is typically measured by sales volume, value addition, and profit margins. Sales volume reflects the quantity of onions sold, influenced by demand and supply dynamics. Value addition involves activities such as sorting, grading, and packaging that enhance product quality and price. Profit margin, calculated as the difference between selling price and total costs, is a key indicator of trader profitability. In Kampala markets, onion market performance might vary widely due to seasonal supply fluctuations and post-harvest losses.

2.8 External Factors Affecting Market Performance of onions

External factors, such as market infrastructure and consumer preferences, significantly influence onion market performance. Kalerwe and Kasubi markets lack cold storage and proper sanitation, leading to quality deterioration (FAO, 2018). Consumer demand for high-quality, blemish-free onions drives competition, yet local traders often fail to meet these standards due to poor handling practices (Ampaire et al., 2020). Additionally, transportation challenges, including poor road networks and high fuel costs, increase operational costs, further reducing profit margins (Okello et al., 2018).

2.9 Link between Handling Practices and Market Outcomes

Post-harvest handling practices directly impact onion quality, shelf life, and marketability, thereby influencing market performance. Proper curing reduces weight loss and spoilage, enabling traders to maintain stock quality and command higher prices (Kader, 2005). Sorting and grading enhance visual appeal, increasing consumer willingness to pay (FAO, 2018). Studies in similar contexts, such as Kenya, show that traders using ventilated packaging achieve 15–20% higher sales volumes compared to those using traditional methods (Muthini et al., 2017). In Uganda, limited adoption of these practices correlates with lower market performance, as traders incur losses from spoilage and fail to add value (Tumwesigye et al., 2020).

Quantitative studies provide evidence of the relationship between post-harvest practices and market performance. For example, Kitinoja and Al Hassan (2012) found that adopting low-cost technologies, such as raised drying racks, reduced onion losses by 20% and increased profit margins by 10% in West African markets. Similarly, a study in Ethiopia reported that

traders using proper storage techniques achieved 30% higher sales volumes due to reduced spoilage (Bezabih et al., 2015). These findings challenge the hypothesis that post-harvest practices do not increase market performance, suggesting that specific practices have measurable economic benefits.

Despite the potential benefits, several constraints limit the impact of post-harvest practices on market performance. High initial costs of technologies, such as ventilated crates, deter adoption among small-scale traders (FAO, 2018). Lack of access to extension services and training further restricts knowledge dissemination (Namara et al., 2016). Moreover, market dynamics, such as oversupply during peak seasons, can negate the benefits of improved handling by driving down prices (Okello et al., 2018). These constraints highlight the need for targeted interventions to enhance the effectiveness of post-harvest practices.

While existing literature provides insights into post-harvest handling and market performance, several gaps remain relevant to the Kampala context. First, there is limited research specifically characterizing onion traders in Kalerwe and Kasubi markets based on their adoption of recommended practices. Most studies focus on broader agricultural markets or other crops, limiting contextual specificity (Tumwesigye et al., 2020). Second, quantitative data on onion market performance metrics, such as sales volumes and profit margins, are scarce for Kampala, with most studies relying on qualitative assessments (Okello et al., 2018). Third, the causal relationship between specific post-harvest practices and market performance has not been adequately explored in Uganda, particularly through empirical methods like regression analysis. Addressing these gaps will provide a clearer understanding of how to improve onion trading in Kampala.

2.13 Theoretical Framework

The study is grounded in the value chain theory, which posits that each stage of a commodity's supply chain, including post-harvest handling, adds value and influences market outcomes. Effective post-harvest practices enhance product quality, reduce losses, and increase competitiveness, thereby improving market performance. The Technology Acceptance Model (TAM) also informs the study, explaining traders' adoption of recommended practices based on perceived usefulness and ease of use. These frameworks provide a lens to analyse how handling practices translate into economic benefits for onion traders.

CHAPTER THREE

METHODS AND MATERIALS

3.1 Study area

This study was conducted in Kalerwe and Kasubi markets. The two markets of Kalerwe and Kasubi are located in Kawempe south and Rubaga divisions respectively, in Kampala city and also a major business centre of Uganda. Kalerwe market is located along Gayaza road, 5 Km from Kampala city centre. The market sells fruits, vegetables, meat, matooke, cassava, potatoes and yams among other foods. The market receives supplies from Luwero, Mbarara, Wakiso and Mukono among other districts. On the other hand, Kasubi market is situated in Kasubi and is neighboured by Kawaala market and Kasubi mosque. This market primarily sells fruits, vegetables, meat and other foods.

3.2 Study design

This study employed a cross sectional study design from June to August 2025 to determine the post-handling practices and market performance of onions in Kalerwe and Kasubi markets. A convenient sampling strategy was adopted, onion traders in Kasubi and Kalerwe markets were included in this study since the two markets were accessible. The two markets were randomly selected. Using systematic sampling procedure a total sample of 102 onion traders were selected for interviews. All onion traders in Kasubi and Kalerwe markets who consented to participate in this study were included. Traders who opted to decline from participating in this study were excluded.

3.6 Data collection

A structured questionnaire was administered to the vendors and marketers of onions in Kalerwe and Nakasero markets. The questionnaire captured data on the demographics of the onion sellers, participation of the onion traders in the recommended post-harvest handling practices of onions sellers and the quantity of onion sells among the traders.

3.7 The key variables of the study

3.7.1 Independent variables

The demographics of onion traders, and the recommended post-harvest handling practices (sorting, packaging, transporting and storage) were predictor factors in this study.

3.7.2 Dependent variable

Market performance of onions (sales and profit margin) was the outcome variable for this study.

3.8 Data management and analysis

The collected data was cleaned and coded in Microsoft Excel and later exported to STATA version 14.2 for analysis. Frequencies and percentages were generated to summarize the post-harvest handling practices and demographics of onion traders. Ordinary Least Squares regression (OLS) model was run to establish the effect of post-harvest handling practices (sorting, packaging, transporting and storage) on market performance (sales and profit margin) of onions. Multiple regressions using OLS were used to analyze the factors affecting market performance of onions. The model is specified to achieve objective (iii) as follows:

Implicit Function $Y = f(X_1, X_2, X_3, X_4, \mu_i)$

Explicit Function $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5\mu_i$

Where:

Y = Market performance of onions (Dependent Variable) (N)

a = Constant

X_1 = sorting

X_2 = packaging of onions (1=yes; 0= Otherwise)

X_3 = transporting (1=yes; 0= Otherwise)

X_4 = storage of onions (1=yes; 0= Otherwise)

X_5 = trader demographics (education level, sex, years in onion trader and age)

$b_1 \dots b_5$ = Coefficients

$X_1 \dots X_5$ = Independent Variables μ = Disturbance Term

3.9 Ethical consideration

Verbal consent was obtained from the study participants prior to issuing of the questionnaire. The collected data was used for only purposes of achieving the study objectives. Confidentiality of the study participants was ensured through use of anonymous identifiers.

CHAPTER FOUR

RESULTS AND DISCUSSION

This study investigated the post-handling practices of onion traders and market of onions in Kalerwe and Kasubi markets in Kamapla, Uganda.

4.1 Demographics of the onion sellers in Kalerwe and Kasubi markets

In this study, 102 onion traders in Kalerwe and Kasubi markets were surveyed. Of these 57.8% (n = 59) were males, most (43.1%) of the traders were aged 31–35 years, and majority (58.8%) of the traders (58.8%) were married. Most traders, 72 (70.6%), were Christian, 44.1% of the traders had attained secondary education and most, 59.8% had 1–5 years of experience in onion trading. In addition, 70.6% (n = 72) of the surveyed traders were retailers and 70.6% (n = 30) of them were wholesalers as summarized in Table 1.

Table 1. Attributes of onion traders in Kalerwe and Kasubi markets

Attribute	Frequency, (n)	Percent, (%)
Age (years)		
20 – 25	6	5.9
26 – 30	20	19.6
31 – 35	44	43.1
≥ 36	32	31.4
Sex		
Male	43	42.2
Female	59	57.8
Marital status		
Single	13	12.7
Married	60	58.8
Widowed	18	17.7
Divorced	11	10.8
Religion		
Christian	72	70.6
Muslim	30	29.4
Education level		
Primary	40	39.2
Secondary	45	44.1
Tertiary	17	16.7

Experience (years)		
1 – 5	61	59.8
6 – 10	41	40.2
Type of trader		
Retailers	72	70.6
Traders	30	29.4

4.2 Characteristics of onion retailers based on the use of recommended post-harvest practices

Among retailers, the adoption of recommended onion post-harvest practices varied. For sorting and grading, 87.5% of divorced retailers and 75.9% of those aged 31–35 years showed the highest compliance. Packaging had lower adoption, with single retailers (44.4%) and those with primary education (40.0%) leading. Transporting practices were most adopted by tertiary-educated retailers (60.0%) and those with 1–5 years of experience (54.8%) in onion trading. Storage practices were universally adopted (100%) across all retailer groups. Overall compliance with post-harvest practices was highest among retailers aged 36 years or older (78.1%) and those with primary education (100.0%). These findings are presented in Table 2.

Table 2. Characteristics of onion retailers in Kalerwe and Kasubi markets

Particulars	Post-harvest practices				
	Sorting and grading n (%)	Packaging n (%)	Transporting n (%)	Storage n (%)	Overall n (%)
Age of retailers (yrs)					
20-25	2 (66.7)	2 (66.7)	2 (66.7)	3 (100.0)	3 (4.2)
26-30	9 (60.0)	5 (33.3)	8 (53.3)	15 (100.0)	15 (20.8)
31-35	22 (75.9)	9 (31.0)	13 (44.8)	29 (100.0)	29 (40.3)
≥ 36	16 (64.0)	9 (36.0)	11 (44.0)	25 (100.0)	25 (34.7)
Education					
Primary	27 (67.5)	16 (40.0)	15 (37.5)	40 (100.0)	40 (55.6)
Secondary	19 (70.4)	9 (33.3)	16 (59.3)	27 (100.0)	27 (37.5)
Tertiary	3 (60.0)	0 (0.0)	3 (60.0)	5 (100.0)	5 (6.9)
Experience (yrs)					
1 – 5	30 (71.4)	13 (30.9)	23 (54.8)	42 (100.0)	42 (58.3)
6 – 10	19 (63.3)	12 (40.0)	11 (36.7)	30 (100.0)	30 (41.7)

Marital status					
Single	4 (44.4)	4 (44.4)	1 (11.1)	9 (100.0)	9 (12.5)
Married	31 (73.8)	17 (40.5)	21 (50.0)	42 (100.0)	42 (58.3)
Widowed	7 (53.9)	4 (30.8)	7 (53.9)	13 (100.0)	13 (18.1)
Divorced	7 (87.5)	0 (0.0)	5 (62.5)	8 (100.0)	8 (11.1)
Sex					
Male	19 (63.3)	11 (36.7)	15 (50.0)	30 (100.0)	30 (41.7)
Female	30 (71.4)	14 (33.3)	19 (45.3)	42 (100.0)	42 (58.3)

4.3 Characteristics of onion wholesalers based on the use of recommended post-harvest practices

Wholesalers showed high adoption of most onion post-harvest practices. Sorting and grading had the highest compliance among wholesalers aged 20–25 years (100.0%), but only 28.6% of those aged 36 years or older adopted this practice. Packaging, transporting, and storage practices were adopted by nearly all wholesalers (100.0%) across most demographic groups, except for sorting. Overall compliance was highest among tertiary-educated wholesalers (70.6%) and those aged 20–25 years (50.0%). Notably, no wholesalers with only primary education were found to participate in trading onions at wholesale level as summarized in Table 3.

Table 3. Characteristics of onion wholesalers in Kalerwe and Kasubi markets

Particulars	Post-harvest practices				
	Sorting and grading	Packaging	Transporting	Storage	Overall
	n (%)	n (%)	n (%)	n (%)	n (%)
Age of wholesalers					
20-25	3 (100.0)	3 (100.0)	3 (100.0)	3 (100.0)	3 (10.0)
26-30	3 (60.0)	5 (100.0)	5 (100.0)	5 (100.0)	5 (16.7)
31-35	12 (80.0)	15 (100.0)	15 (100.0)	15 (100.0)	15 (50.0)
≥ 36	2 (28.6)	7 (100.0)	7 (100.0)	7 (100.0)	7 (23.3)
Education					
Primary	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Secondary	12 (66.7)	18 (100.0)	18 (100.0)	18 (100.0)	18 (60.0)
Tertiary	8 (66.7)	12 (100.0)	12 (100.0)	12 (100.0)	12 (40.0)

Experience (yrs)					
1 – 5	12 (63.2)	19 (100.0)	19 (100.0)	19 (100.0)	19 (63.3)
6 – 10	8 (72.7)	11 (100.0)	11 (100.0)	11 (100.0)	11 (36.7)
Marital status					
Single	3 (75.0)	4 (100.0)	4 (100.0)	4 (100.0)	4 (13.3)
Married	12 (66.7)	18 (100.0)	18 (100.0)	18 (100.0)	18 (60.0)
Widowed	3 (60.0)	5 (100.0)	5 (100.0)	5 (100.0)	5 (16.7)
Divorced	2 (66.7)	3 (100.0)	3 (100.0)	3 (100.0)	3 (10.0)
Sex					
Male	9 (69.2)	13 (100.0)	13 (100.0)	13 (100.0)	13 (43.3)
Female	11 (64.8)	17 (100.0)	17 (100.0)	17 (100.0)	17 (56.7)

4.4 Level of onion market performance across onion retailers in Kalerwe and Kasubi markets

In this study, onion retailers recorded an average annual sales volume of 8,342 Kg (standard deviation 3,394.2), with the highest sales linked to packaging practices (8,591.9 Kg). Value addition was achieved by 100% of retailers for packaging and storage, 64.0% for sorting and grading, and 48.2% for transporting. The average annual profit margin was 4.9 million Ugandan Shillings (standard deviation 1.98 million), with the highest margins associated with packaging practices (5.0 million Ugx) as presented in Table 4.

Table 4. Onion market performance across onion retailers in Kalerwe and Kasubi markets

Particulars	Post-harvest practices				
	Sorting and grading (n = 49)	Packaging (n = 25)	Transporting (n = 34)	Storage (n = 72)	Overall (n = 72)
Annual Sales (Kg), Mean (SD)	8361.8 (3450.3)	8591.9 (3966.7)	8134.3 (2763.4)	8342 (3394.2)	8342 (3394.2)
Value addition, n (%)	16 (64.0)	25 (100.0)	12 (48.2)	25 (100.0)	25 (34.7)
Annual Profit margin (Ugx.000'000), Mean (SD)	4.75 (1.8)	5.0 (0.9)	4.75 (1.8)	4.9 (1.98)	4.9 (1.98)

4.5 Level of onion market performance across onion wholesalers in Kalerwe and Kasubi markets

The findings on the level of onion market performance across onion wholesalers are summarized in Table 5. Onion wholesalers achieved significantly higher annual sales, averaging 41,901.3 kg (standard deviation 15,328.3), consistent across all post-harvest practices. Value addition was reported by 100% of wholesalers for packaging, transporting, and storage, and by 66.7% for sorting and grading. The average annual profit margin was 22.5 million Ugandan Shillings (standard deviation 8.2 million), and this was uniform across all practices.

Table 5. Onion market performance across onion wholesalers in Kalerwe and Kasubi markets

Particulars	Post-harvest practices				
	Sorting and grading (n = 20)	Packaging (n = 30)	Transporting (n = 30)	Storage (n = 30)	Overall (n = 30)
Annual Sales (Kg), Mean (SD)	39447.9 (14999.5)	41901.3 (15328.3)	41901.3 (15328.3)	41901.3 (15328.3)	41901.3 (15328.3)
Value addition, n (%)	20 (66.7)	30 (100.0)	30 (100.0)	30 (100.0)	30 (100.0)
Annual Profit margin (Ugx.000'000), Mean (SD)	21.2 (8.9)	22.5 (8.2)	22.5 (8.2)	22.5 (8.2)	22.5 (8.2)

4.6 The effect of post-harvest handling practices on market performance among onion retailers in Kampala market

From Table 6, sorting (coefficient = 0.023, $P = 0.985$) showed slight positive but non-significant effects on sales and profit margin, while packaging (coefficient = -0.075, $P = 0.552$) and transporting (coefficient = -0.019, $P = 0.872$) had a non-significant negative effect; however, storage data was insufficient to return results from the model.

Table 6. OLS regression for post-harvest handling practices sales and profit margin of onion retailers in Kalerwe and Kasubi markets

Post-harvest practice	Sales		Profit Margin	
	coefficient	t (P-value)	coefficient	t (P-value)
Sorting	0.023	0.02 (0.985)	0.023	0.02 (0.985)
Packaging	-0.075	-0.6 (0.552)	-0.075	-0.6 (0.552)
Transporting	-0.019	-0.2 (0.872)	-0.019	-0.2 (0.872)
Regression diagnostics	n =72, F = 0.13, P (F) = 0.942, R ² = 0.0057, RMSE = 0.508		n =72, F = 0.13, P (F) = 0.942, R ² = 0.0057, RMSE = 0.508	

4.7 The effect of post-harvest handling practices on market performance among onion wholesalers in Kampala market

In this study, sorting (coefficient = 0.2, $P = 0.317$) shows a moderate positive but non-significant effect on sales and profit margin; but packaging, transporting, and storage data were insufficient to return results from the model. These findings are summarized in Table 7.

Table 7. OLS regression for post-harvest handling practices sales and profit margin of onion wholesalers in Kalerwe and Kasubi markets

Post-harvest practice	Sales		Profit Margin	
	coefficient	t (P-value)	coefficient	t (P-value)
Sorting	0.2	1.02 (0.317)	0.2	1.02 (0.317)
Regression diagnostics	n=30, F=1.04, P(F)=0.317, R ² =0.036, RMSE=0.507		n=30, F=1.04, P(F)=0.317, R ² =0.036, RMSE=0.507	

The demographic profile of onion traders in Kalerwe and Kasubi markets revealed a diverse group, with a majority being female (57.8%), aged 31–35 years (43.1%), and married (58.8%), Christian (70.6%), and possessing secondary education (44.1%). Most traders had 1–5 years of experience (59.8%), and retailers dominated (70.6%) compared to wholesalers (29.4%). These characteristics are comparable to those from other studies in other African markets, such as those in Nigeria, where onion trading is often dominated by small-scale retailers, many of whom are women with moderate education levels (FALOLA et al., 2023). The high proportion of retailers over wholesalers reflects the structure of urban markets in

Uganda, where retail trade caters to local consumer demand, similar to findings in Kenya's Nairobi markets (Shackleton et al., 2009).

Among retailers, the adoption of recommended post-harvest practices varied significantly. Storage practices were universally adopted (100%), indicating a strong awareness of the importance of proper storage to prevent spoilage, a finding consistent with studies in Ethiopia, where onion traders prioritized storage to maintain quality (Emana et al., 2017). Sorting and grading were most adopted by divorced retailers (87.5%) and those aged 31–35 years (75.9%), suggesting that specific demographic groups may be more motivated to implement quality-enhancing practices, possibly due to economic pressures or experience. However, packaging adoption was lower, particularly among single retailers (44.4%) and those with primary education (40.0%), which may reflect limited access to resources or knowledge, a challenge also noted in Ghana's vegetable markets (Gandaa 2022). Transporting practices were more common among tertiary-educated retailers (60.0%) and those with 1–5 years of experience (54.8%), indicating that education and experience influence the adoption of practices requiring technical know-how or investment.

Wholesalers of onions showed higher compliance with most post-harvest practices, with 100% adoption of packaging, transporting, and storage across most demographic groups, except for sorting and grading, which was notably low among those aged ≥ 36 years (28.6%). The high adoption of packaging and transporting practices among wholesalers are comparable to findings from Tanzania, where wholesalers invest in these practices to meet bulk buyer standards (Goweke et al., 2024). The absence of primary-educated wholesalers suggests that wholesale trading requires higher literacy or resource access and this findings is in agreement with those on tomatoe value chain from Ghana (Wongnaa et al., 2014).

The findings of this study also revealed that retailers recorded an average annual sales volume of 8,342 kg, with the highest sales linked to packaging practices (8,591.9 kg). Value addition was achieved by 100% of retailers for packaging and storage, but only 64.0% for sorting and grading and 48.2% for transporting. The average annual profit margin was 4.9 million Ugandan Shillings (Ugx), with packaging yielding the highest margins (5.0 million Ugx). These findings partially reject the first hypothesis, which posited low market performance among onion traders, as the sales and profit margins indicate moderate to high performance, particularly for retailers adopting packaging practices. This is comparable to

studies in Kenya, where packaging was linked to higher vegetable market performance due to improved product presentation and reduced losses (Joseph et al., 2021).

Wholesalers achieved significantly higher sales (41,901.3 kg) and profit margins (Ugx. 22.5 million), with 100% value addition for packaging, transporting, and storage, and 66.7% for sorting and grading. The higher performance of wholesalers reflects their larger scale of operation and access to broader markets, a pattern observed in Nigeria's onion supply chains (Adewale et al., 2018). The uniformity of profit margins across post-harvest practices among wholesalers suggests that these practices are standardized at the wholesale level, possibly due to market demands for consistency.

The third objective examined the effect of post-harvest handling practices on market performance using ordinary least squares (OLS) regression. For retailers, sorting (coefficient 0.023, $P = 0.856$) and transporting (coefficient 0.032, $P = 0.795$) showed slight positive but non-significant effects on sales and profit margins, while packaging had a non-significant negative effect (coefficient -0.105, $P = 0.409$). Insufficient data prevented analysis of storage effects. These findings support the second hypothesis, which stated that participating in post-harvest practices does not significantly increase market performance, suggesting that other factors, such as market access or pricing strategies, may play a larger role. This aligns with a study in Ethiopia, where post-harvest practices had limited impact on onion market performance due to infrastructural constraints (Bezabih et al., 2015).

For wholesalers, only sorting showed a moderate positive but non-significant effect, with insufficient data for other practices. This further supports the second hypothesis and indicates that while sorting may contribute to quality improvements, its impact on sales and profits is not statistically significant. Similar results were reported in Tanzania, where post-harvest practices had variable impacts on vegetable market performance, often overshadowed by market structure and demand (Mushi et al., 2021).

The findings resonate with several African studies. In Ethiopia, Bezabih et al. (2015) found that storage was universally adopted among onion traders, but sorting and grading were less common due to limited awareness, mirroring the variable adoption rates in this study. In Nigeria, Adewale et al. (2018) reported that wholesalers achieved higher sales and profits than retailers, consistent with the current study's findings, though packaging was less emphasized in Nigeria due to reliance on traditional methods. In Kenya, Mwangi et al. (2020)

highlighted the role of packaging in enhancing vegetable market performance, supporting the high sales linked to packaging among retailers in Kalerwe and Kasubi. However, the non-significant effects of post-harvest practices on market performance align with findings in Ghana, where Agyemang et al. (2019) noted that external factors like transportation infrastructure and market competition often outweigh the benefits of post-harvest practices.

The universal adoption of storage practices suggests that traders recognize their importance in reducing post-harvest losses, a critical factor in perishable commodity markets like onions. However, the lower adoption of sorting, grading, and packaging, particularly among retailers, indicates a need for targeted training and resource support, especially for less-educated or single traders. The non-significant effects of post-harvest practices on market performance suggest that interventions should also address external factors such as market access, infrastructure, and pricing mechanisms.

Limitations include the insufficient data for storage (retailers) and most practices (wholesalers) in the regression analysis, which restricted the ability to fully assess their impact. Additionally, the study focused on two markets in Kampala, limiting generalizability to other Ugandan or African contexts. Future research should include larger samples and additional markets to validate these findings and explore other influencing factors, such as market infrastructure and consumer preferences.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study assessed post-harvest handling practices and their impact on onion market performance in Kalerwe and Kasubi markets, Kampala, Uganda. Retailers showed varied adoption of practices, with 100% compliance in storage, while sorting and grading were highest among divorced retailers (87.5%). Wholesalers exhibited near-universal adoption of packaging, transporting, and storage (100%), with sorting highest among younger traders (100%). Retailers averaged 8,342 kg in sales and 4.9 million UGX in profits, while wholesalers achieved 41,901.3 kg and 22.5 million UGX. OLS regression analysis indicated non-significant effects of post-harvest practices on sales and profits, partially supporting the hypothesis of low market performance influence.

6.2 Recommendations

Enhance training programs for retailers: Develop targeted training initiatives focusing on sorting, grading, and packaging techniques for retailers, particularly those with lower education levels and less experience, to improve post-harvest handling of onions and boost market performance.

Promote sorting and grading for wholesalers: Implement awareness campaigns or incentives to encourage wholesalers, especially older traders, to adopt sorting and grading practices for onions to enhance their market outcomes.

Improve data collection on storage practices: Prioritize comprehensive research and data gathering on storage methods of onions to better understand their role in improving sales and profitability for both retailers and wholesalers.

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ANNEXES

ANNEX I: Questionnaire

POST-HARVEST HANDLING PRACTICES AND EFFECT ON MARKET PERFORMANCE: A CASE OF ONION TRADERS IN KAMPALA

My name is Nyesiga Osbert, a student at the Department of Agribusiness and Natural Resource Economics of Makerere University. I am conducting a study titled “*Post-harvest handling practices and their effect on market performance: A case of onion traders in Kampala*”. The high perishability of onions undermines their importance in the diets of humans. Onions are a crucial source of minerals and vitamins and are widely consumed globally. The demand for good quality onions in Uganda is high, yet challenges faced in handling onion produce right from the farm to market continue to lead to physical damages and waste. To the extent that traders are unable to engage in recommended PHH practices, the quality of the onions sold can deteriorate, a phenomenon that can also reduce market price and quantity sold. Poor post-harvest handling practices of onions by traders and sellers have been reported to lead to onion damage and losses. This study therefore aims at assessing the effect of post-harvest handling practices on market performance across onion traders in Kampala

We would like to ask you some questions about the PHH practices you undertake in your onion business. Your participation in this survey is voluntary: Do you agree to take part in this survey (0 = No; 1 = Yes)

A. Identification and interview details: Urban Onion Wholesalers or RetailersA1. Retailer/Wholesaler (*Tick appropriate*)

Date of interview: Date: ____Month Year_____	A1	Market Zone	
Interviewed by:	A2	Division:	
Contact of respondent:	A3	Name of the market/place:	

A2. Trader information

Name	Gender (1=M; 2 =F)	Age (yrs)	Marital status	Education Level	Experience (yrs)	Religio n

B. Post-harvest handling practices of onion traders

B1. Where do you source onions?

Farmer directly ☐Middlemen ☐Wholesale market ☐

Others (specify).....

B2. Do you sort and grade your onions? (*Probe more and get to know how they really do it*)Yes ☐No ☐

B3. Do you package your onions?

Yes ☐No ☐

B4. If yes, what do you use for packaging?

Polythene bags (Good/Worn) ☐Wooden crates ☐Plastic crates (Good/Worn) ☐

Sacks (Good / Torn)

Other (specify).....

B5. Do engage in transporting onions?

Yes ☐

No ☐

B6. If yes, how do you transport the onions? (*Probe deeply to understand the means and the destination of the transported onions*).

Vehicle ☐

Motorcycle ☐

Bicycle ☐

Other (specify).....

B7. Do you store onions?

Yes ☐

No ☐

B8. If yes, what do you use for storage?

Refrigerators (Good/Worn) ☐

Cooling chambers (Good/Worn) ☐

Open storage (pour on the flour) (Good / Torn) ☐

Other (specify).....

C. Market Performance of Onions

C1. What is the transaction volume and price of onion trading in a year?

Quantity of onion sold (kg/week)	Effective months of onion trading/year	Purchase price (UGX/kg)	Sells price (UGX/kg)

C2. Which months of a year have varying onion trading as a result of: “no supply/sale”; “less supply /sale”, and; “high supply/sale” (*Use codes below, and probe: how do you cope with the shortage/oversupply*).

	J	F	M	A	M	J	J	A	S	O	N	D
1. Onion purchase in a year												
2. Onion sale in a year												
	0 = “no supply/sale”				1 = “less supply/sale”				2 = “high supply/sale”			
3. Quantity of onion purchase (_____kg/week) on average during periods of minor sale, and major sale of mushroom produce					_____kg/week				_____kg/week			

C3. Do you do value addition to your onions?

Yes ☐

No ☐

C4. If yes, how do you it? (*Probe more and get the different ways in which value addition is done*)

.....
.....

*****END OF INTERVIEW*****