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Analysis of Quantity and Value of Post-Harvest Losses in Marketing Pawpaw and Banana in Selected Markets in Kano Metropolis, Kano State, Nigeria

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***James D[1], Ahmed U. Shu'aib[2]., Abdullahi T. lawal[2], Zaharaddeen Y. AbdullahI[2] & Alhassan, A.[2]**

[1]Department of Agricultural Extension and Management Federal College of Agricultural Produce Technology Kano, Kano State Kano, Nigeria

[2]Department of Agricultural Economic and Extension, Aliko Dangote University of Science and Technology Wudil, Kano State, Nigeria.

*Corresponding Author's E-mail: melajames2016@gmail.com, Phone No; 08027993368

Abstract

The study analyzed the quantity and value of post-harvest losses in pawpaw and banana marketing in selected markets in Kano Metropolis of Kano State, Nigeria. Purposefully specific markets were selected for the study due to their significant concentration of fruit traders operating at both retail and wholesale levels included the Yan Lemo fruit market, Yankaba, and Yankura. Copies of structured questionnaire were used to collect data, descriptive statistics and Post-Harvest Loss Estimation (PHLE) Model were used to achieve the two objectives. The age distribution shows that majority of wholesale marketers had a mean age of 48.50 years, while retail pawpaw marketers fall within the 31-40 age group (51.7%). It was revealed that retail pawpaw marketers predominantly have a mean of 12 persons; wholesale pawpaw marketers had a larger mean household size of 18 persons. During the sorting of pawpaw the mean quantity lost was 2.53 pieces and the mean value lost was approximately ₦3,640.00. In the banana marketing process, significant losses also occurred. During the sorting stage, the mean quantity lost was 1.58 pieces (with a range from 1 to 4 pieces) and the mean value lost was ₦2,705.26 (minimum ₦2,000, maximum ₦3,600). This reflects similar issues as seen with pawpaw, where sorting inadequacies can lead to economic setbacks. The study also recommended the need for effective strategies to reduce post-harvest losses, and adopting new management techniques

Key words; post-harvest, losses, Quantity, Value, Retail, Wholesale

Introduction

Quantitative food loss can be defined as a reduction in the weight of edible grain or food available for human consumption. This reduction in weight can be caused by factors such as spoilage, consumption by pests, and physical changes in temperature, moisture content, and chemical changes. However, it's important to note that reduction in weight due to drying, a necessary post-harvest process for all grains, should not be counted as loss since it does not result in a loss of food value Mary *et al*., (2021).

Qualitative loss can occur due to insect pests, rodents, handling, physical changes, or chemical changes in fat, carbohydrates, and protein, and contamination of mycotoxins, pesticide residues, insect fragments, or excreta of rodents and birds. When this qualitative deterioration makes food unfit for human consumption and is rejected, it contributes to food losses. Post-harvest losses in tropical fruits vary widely from 10

percent to 80 percent in both developed and developing countries (James *et al*., 2018, Mohammed *et al.,* 2021).

In most developing countries, these losses are mainly due to poor infrastructure and logistics, poor farm practices, lack of post-harvest handling knowledge, and a convoluted marketing system (FAO, 2016; Aminu *et al.*2020). Approximately 40 to 50 percent of horticultural products, including fruits and vegetables, are lost before they reach consumers due to high rates of bruising, water loss, and subsequent decay during post-harvest handling Aloka, *et al* (2024). Fruits and vegetables in sub-Saharan Africa suffer considerable post-harvest losses, affecting their quality, quantity, aesthetic appeal, and nutrition (Kereth *et al*., 2013 Gaurav *et al*., 2023). There is a need for efforts to be geared towards increasing production and curtailing post-harvest losses through proper value addition. Establishment of cold storage facilities across the country would greatly help in reducing wastes that accrue during the marketing Aminu *et al.* (2020). It is against this background this study was design to determine the following objective;

The main objective of the study is to analyze quantity and value of post-harvest losses in pawpaw and banana marketing in selected markets in Kano Metropolis of Kano State. The specific objectives are to;

i. describe the socio-economic characteristics of pawpaw and banana marketers in selected markets of Kano metropolis
ii. determine the quantities and values of pawpaw and banana lost during marketing at different stages of post-harvest losses.

Methodology

Study Area

The study was conducted in Kano State, Nigeria. which is situated in the northern region of Nigeria. The specific markets selected for the research include the Yan Lemo fruit market, located in Kumbotso Local Government Area along Na'ibawa Zaria Road and opposite Sa'adatu Rimi College of Education. Additionally, Yankaba market is situated along Hadeja road in Nasarawa LGA, and Yankura is positioned in Fagge LGA, bordering Sabongari market to the north and Singa market to the west. These markets have been chosen purposefully for the study due to their significant concentration of fruit traders operating at both retail and wholesale levels.

Sampling procedure.

Table 1a; sample frame and sample size for pawpaw sellers.

Market	**Sampling Frame Whole seller**	**Retailer**	**Sample size Whole seller**	**Retailer**
Namibia ‘Yan lemo	39	110	36	86
‘yankaba	1	14	1	14
‘yankura	2	20	2	20
Total	**42**	**144**	**39**	**120**

Source; Nigeria Fruits Sellers Association Kano Chapter 2024.

Table 1b; sample frame and sample size for banana marketers.

Market	**Sampling Frame Whole seller**	**Retailer**	**Sample size Whole seller**	**Retailer**
Na’ibawa ‘Yan lemo	16	90	16	76
‘yankaba	1	13	1	13
‘yankura	2	12	2	12
, Total	**19**	**115**	**19**	**101**

Source; Nigeria Fruits Sellers Association Kano Chapter 2024.

Analytical Tools

The analysis of the data for this study involved using descriptive statistics, such as frequency counts, percentages, mean, and standard error will be used. in the analysis while post-harvest loss estimation model was adopted to measure post-harvest losses of pawpaw and banana.

Post-Harvest Loss Estimation (PHLE) Model

The PHL model is a tool used to measure post-harvest loss of agricultural commodities. It aims to quantify post-harvest losses at wholesale and retail levels of marketing to achieve objective (iv). The main post-harvest activities in the supply chain include sorting, packaging, storage, and transportation. The model will use computing principles and index estimation to estimate losses at different stages of post-harvest. Other literature was reviewed to validate the accuracy of the model. It was found that the developed model was in agreement and this followed the works of

(Aulakh and Regmi, 2014). Mohammed *et, al.,* (2021). The total PHL at any post-harvest stage for a specific commodity is the sum total of food losses occurring at each stage of the processes of the PHLE Model, expressed as: [missing information].

$TPHL = \sum (\sum U_i \sum S_1 + \sum P_1 + \sum R_1 + \sum T_1 \sum D_i)$ ……..... (1)

Where,

TPHL = Total post-harvest losses (kg)

U_i = PHL during loading (kg)

S_i = PHL during sorting (kg)

P_i = PHL during packaging (kg)

R_i = PHL during storage (kg)

T_i = PHL during transportation (kg)

D_i = PHL during downloading (kg).

Table 1: Distribution of Pawpaw and Banana marketers according to their socio-economic variables (Quantitative)

(PAWPAW)					**(BANANA)**			
variable	Wholesale frequency	percentage	Retailer Frequency	percentage	Wholesale frequency	percentage	Retailer frequency	percentage
Gender								
Male	40	100.0	115	95.8	18	94.7	113	98.3
Female	-	-	5	4.2	1	5.3	2	1.7
Total	40	100	120	100.0	19	100.0	115	100.0
Marital Status								
Married	1	2.5	126	96.7	15	79	77	67.0
Single	39	97.5	4	3.3	4	21	38	33.0
Total	40	100.0	120	100.0	19	100.0	115	100.0
Education								
Quaranic	16	40.0	52	43.3	1	5.3	20	17.5
Primary	20	50.0	56	46.7	4	21.1	10	8.5
Secondary	4	10.0	12	10.0	7	36.9	73	62.6
Tertiary	-	-	-	-	7	36.8	12	10.4
Total	40	100.0	120	100.0	19	100.0	115	100.0
CooperativeMembership								
Yes	39	97.5	111	92.5	10	52.6	76	66.1
No	1	2.5	9	7.5	9	47.4	39	33.9

Total	40	100.0	120	100.0	19	100.0	115	100.0

Source: Field Survey, 2024

Result in table 1, shows that wholesale pawpaw marketers are male (100%), while retail pawpaw marketers were predominantly male (95.8%). wholesale banana marketers were also mostly male. Retail banana marketers were male (98.3%), this result suggests that males dominated retail pawpaw marketing and wholesale pawpaw marketing, as well as both retail and wholesale banana marketing Cai, *et al.,* (2021) (). Differences in gender preferences might stem from the different roles that women and men play in the banana value chain, such as cooking for women and beer production for men Das, *et al.,* (2023).

The result about marital status shows that wholesale pawpaw marketers were single (97.5%), while majority of retail pawpaw marketers were married (96.7%), wholesale banana marketers were married (79%), while Retail banana marketers were married (67.0%). Married individuals may have more stability and resources for engaging in retail marketing, while single individuals may find wholesale marketing more accommodating to their circumstances (Lawal *et al*, 2021).

The result on level of education reveals that Retail pawpaw marketers are almost evenly split between Quranic (43.3%) and primary education (46.7%), while wholesale pawpaw marketers have Quranic (40%) and primary education (50.0%). Banana wholesale marketers have primary (21.1%), secondary (36.9%), and tertiary education (36.8%). While Retail banana marketers had secondary (62.6%). Banana marketers generally have higher levels of formal education than pawpaw marketers, which may influence their marketing strategies and access to information Methamontri, *et al.*, (2022).

The result revealed that wholesale (97.5%) pawpaw marketers were members of marketing association likewise (92.5%) retailers were members. Result also shows banana retail and wholesale marketers show lower membership (66.1%) and (52.6%,) compared to pawpaw marketers. Membership in marketing associations can provide access to resources, market information, and collective bargaining power, which may explain the higher participation rates among pawpaw marketers. Encouraging membership in marketing associations can empower marketers, improve their access to resources, and enhance their bargaining power (Ma, *et al*, 2023).

Table 2: Distribution of Quantities and Values of Pawpaw and Banana lost during marketing at different stages of one circle selling the quantities in the table, (1week).

Actors	Stage	Quantity of pawpaw/banana lost in 12pieces (15) kg/100pieces					Value of pawpaw/banana lost in 12pieces (15) kg/ 100pieces				
		Min.	Max.	Mean	STD.	Var.	Min.	Max.	Mean	STD.	Var.
Wholesalers Pawpaw	Uploading	1	2	1.05	.221	.049	1000	2400	1291.2500	212.40	45113.78
	Sorting	2	5	2.53	.847	.717	2000	11250	3640.0000	2627.59	6904256.
	Packaging	2	3	2.18	.385	.148	2000	3200	2532.5000	328.46	107891.0
	Storage	1	5	2.35	.770	.592	1000	2400	1291.2500	212.40	45113.78
	Transportation	1	3	2.00	.679	.462	2000	3200	2540.0000	318.49	101435.8
	Unloading	1	3	2.47	.554	.307	2000	3200	2567.5000	338.46	114557.6
Wholesalers Banana	Uploading	1	1	1.00	.000	.000	1000.00	2400.00	1315.7895	284.82579	81125.73
	Sorting	1	4	1.58	.769	.591	2000.00	3600.00	2705.2632	559.23925	312748.
	Packaging	1	2	1.32	.478	.228	2000.00	3200.00	2542.1053	330.51440	109239.7
	Storage	1	2	1.26	.452	.205	1000.00	2400.00	1315.7895	284.82579	81125.73
	Transportation	1	2	1.32	.478	.228	2000.00	3200.00	2584.2105	360.96038	130292.3
	Unloading	1	2	1.21	.419	.175	2000.00	3200.00	2584.2105	360.96038	130292.3
				RETAIL							
Retailers Pawpaw	Uploading	1	3	1.18	.430	.185		900.00	5400.00	1379.1667	570.109
	Sorting	1	2	1.08	.266	.071		1000.00	4600.00	1477.5000	788.942
	Packaging	1	3	1.20	.460	.212		1000.00	5000.00	1512.5000	850.463
	Storage	1	2	1.05	.219	.048		1000.00	5500.00	1560.8333	907.049
	Transportation	1	4	1.26	.587	.344		1000.00	6000.00	1649.1667	1039.14
	Unloading	1	2	1.08	.264	.070		1000.00	5000.00	1820.0000	1186.23
Retailers Banana	Uploading	1	3	1.35	.496	.246	1500.00	2200.00	1761.7391	160.36286	25716.2
	Sorting	1	4	1.65	.663	.439	1500.00	2200.00	1750.4348	151.23695	22872.6
	Packaging	1	3	1.57	.651	.423	1500.00	2200.00	1740.0000	144.97429	21017.5
	Storage	1	3	1.54	.611	.373	1500.00	2200.00	1703.4783	119.89062	14373.7
	Transportation	1	2	1.11	.315	.099	1500.00	2200.00	1717.3913	140.33848	19694.8
	Unloading	1	2	1.26	.452	.205	1600.00	2200.00	1743.478	139.0004	19321.1

Source*: Field Survey, 2024*

The findings in Table 2, reveal substantial post-harvest losses, which are significant for understanding the economic impact on the marketing of these fruits. In the case of pawpaw during the sorting stage, the mean quantity lost was 2.53 pieces (with a minimum of 2 and a maximum of 5 pieces) and the mean value lost was approximately ₦3,640.00 (with a minimum of ₦2,000 and a maximum of ₦11,250). This substantial

loss underscores the vulnerabilities at this stage, as sorting is critical for maintaining quality, and poor practices can lead to increased waste (Ikpe & Shamsuddoha, 2024). The high variance in both quantity and value signals a significant fluctuation in loss levels, suggesting that some batches may face severe issues while others may not. This suggests that sorting, which is essential for quality control and market readiness, proves to be a particularly hazardous point for both product quantity and value, resonating with findings in other studies that have similarly identified sorting as a critical stage vulnerable to high loss rates. This aligns with broader research which has shown that mishandling during sorting can lead to significant decreases in the overall quality of perishable products, often resulting in economic losses for vendors.

For the packaging stage, pawpaw experienced a mean loss of 2.18 pieces (with a minimum of 2 and maximum of 3) and a mean value loss of ₦2,532.50 (minimum ₦2,000, maximum ₦3,200). Similarly, the storage stage had a mean quantity loss of 2.35 pieces and the same mean value loss as packaging (₦1,291.25). These figures emphasize the need for improving both packaging techniques and storage conditions to mitigate losses. The findings from this table align with broader research on post-harvest losses in fruit marketing, which often highlight that substantial losses occur due to inadequate handling practices, poor infrastructure, and environmental factors such as temperature and humidity (Osei-Kwarteng *et al.,* 2024).

In the banana marketing process, significant losses also occurred. During the sorting stage, the mean quantity lost was 1.58 pieces (with a range from 1 to 4 pieces) and the mean value lost was ₦2,705.26 (minimum ₦2,000, maximum ₦3,600). This reflects similar issues as seen with pawpaw, where sorting inadequacies can lead to economic setbacks. Saha, *et al.,* (2021).

At the retail stage, the losses were comparatively lower, but still notable. The mean losses for uploading, sorting, packaging, and storage ranged from 1.05 to 1.35 pieces, with corresponding mean value losses from ₦1,379.17 to ₦1,512.50. For example, the uploading phase for banana showed a mean loss of 1.32 pieces with a mean value of ₦2,584.21.

The cumulative effect of losing an average of 2.53 pieces of pawpaw during sorting alone can significantly affect the bottom line of producers and marketers, particularly given the high variance in value at this stage. Chandel, *et al*., (2024).) suggest that the economic viability of fruit marketing heavily relies on minimizing these losses. Therefore, the observed losses, such as the ₦3,640.00 mean value loss during pawpaw sorting and similar figures across other stages, highlight the critical need for improved handling practices and better infrastructure. Addressing these issues through training, better packaging, and enhanced logistical approaches can reduce the economic impact of these losses and improve the sustainability of pawpaw and banana marketing (Balana *et al*., (2022).

Conclusion and Recommendations

The study highlights the significance of post-harvest losses in pawpaw and banana marketing in Kano Metropolis, Nigeria. The results demonstrate that post-harvest losses are substantial and occur at various stages of the supply chain. During uploading, sorting, packaging, storage, transportation and unloading average values of ₦1291, ₦3640, ₦2532, ₦1291, ₦2540, ₦2567 likewise in banana wholesale ₦1315, ₦2705, ₦2542, ₦1316, ₦2584, ₦2584 were lost respectively, these losses may lower the profit margin of the respondent. The study also identifies the need for effective strategies to reduce post-harvest losses, including improving transportation facilities, using jute bags for packaging, spreading under shade for storage, training on new management skills, and adopting new management techniques. It is recommended that governmental and non-governmental organizations encourage female participation in pawpaw and banana enterprises to reduce the possible imbalance in the supply chain of pawpaw and banana in the study area.

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