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Utilization of Post-Harvest Management Strategies among Cashew Farmers in Imo State, Nigeria

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Abstract
This study analyzed utilization of post-harvest management strategies among cashew farmers in Imo State, Nigeria. Multi-stage sampling procedure was used to select 72 cashew farmers for this study. Data were collected using structured questionnaire, and were also analyzed with descriptive statistics such as frequency counts, percentages and mean) and inferential statistics (multiple regression). Result of the study revealed that cashew farmers had a mean age of 45.64years, 75.59% were males, 73.61% were married, 86.11% had secondary education. The mean household size was 7 persons, mean years of farming experience was 19.25 years. While, 76.39% were not member of cooperative society, 88.89% had no contact with extension service. The average number of cashew trees owned by the farmers was 161 trees, majority (92.28%) had no access to credit and had mean annual income of ₦82,861.11. Cashew farmers experienced losses mostly during the harvesting (97.2%), processing stage (97.2%), packaging stage (94.4%), storage (80.6%) and distribution/marketing stages (72%). Postharvest management strategies utilized were harvesting as soon as the fruits mature (95.8%), farm-gate sales immediately after harvest to reduce postharvest losses (93.1%). Also, the socio-economic characteristics of farmers influenced the number of postharvest management strategies adopted by them with values of (R^2) = 0.641 and F-ratio value = 22.435 and significant at 5% probability level. Poor extension contacts (98.61%), poor storage facilities (97.22%), poor processing facilities (95.83%), high cost of postharvest management equipment (95.83%) and inadequate knowledge of the use of modern postharvest technologies (94.4%) were constraints to utilization of post-harvest management strategies. The study recommends that extension agents should organize training on cashew postharvest management practices.
Keywords: Cashew, Postharvest losses, Postharvest management

Introduction

Background of the Study

Cashew (*Anacardium occidentale L.),* is a kidney-shaped seed, it is an important tropical cash crop and is commonly referred to as 'Wonder nut'. The crop is a member of the family Anacardiaceae with the natural order Sapinadales (Kaviraj et al., 2023). It is a drought resistant crop that can grow successfully in areas

with a distinct dry season or where the annual rainfall is relatively low (Angela et al., 2023). The production of cashew can solve the economic, social and environmental problems in the world and Nigeria is capable of leading at global stage if there is effective post-harvest handling and management of cashew (Sahie et al., 2023).

Cashew are typically harvested when the plant is fresh and high in moisture and therefore they are distinguished from field crops, which are harvested at the mature stage for grains, pulses, oil seeds or fibre (Semporé et al.,2021). The high moisture content of cashew makes their handling, transportation, value addition and marketing a major challenge especially in Nigeria (Aluko et al., 2023). However, with the high potentials of cashew production in Nigeria, there are some constraints facing cashew production in Nigeria. Some of these constraints are production constraints, marketing constraints and processing constraints such as postharvest losses (Oluyole et al, 2015). Post-harvest losses (PHLs) negatively affect farmers production, social and economic activities as well as represent a waste of resources experienced in the cashew production which are land, labour, capital, entrepreneurship and other vital resources (Stéphane et al., 2020).

Postharvest losses could be described as losses which includes the food loss across the food supply chain from harvesting of cashew until its consumption (Mary, 2021). The losses can broadly be categorized as weight loss due to spoilage, quality loss, nutritional loss, seed viability loss, and commercial loss (Debebe, 2022). In Imo State, farmers try to make the best use of the cashew produced; however, a significant amount of produce is lost in postharvest operations due to a lack of knowledge postharvest management strategies, inadequate technology and/or poor storage infrastructure. Therefore, farmers must practice post-harvest management strategies to reduce their losses in cashew production (United Nations, 2024; Egwuonwu & Ndukauba, 2025).

Post-harvest management strategies refer to a set of practices and techniques aimed at reducing the losses of agricultural produce and food products that occur after they have been harvested but before they reach the end consumers (Ariong et al., 2023). These strategies are essential to ensure food security, reduce waste, and improve the income of farmers (Cossam et al., 2023). Hence, understanding farmers' postharvest management strategies will not only be the key to reduce losses but improving farmers' production capacity, value addition, income and increasing aggregate cashew consumption for its health and nutritional benefit in the area. It is on this background the study will assess post-harvest losses management strategies used by cashew farmers in Imo State, Nigeria. Reducing postharvest losses (PHLs) is fundamental to enhancing sustainable utilization of global food resources (Anyoha et al., 2023). This study therefore analyzed utilization of postharvest management strategies among cashew farmers in Imo State, Nigeria. The study specifically described socio-economic characteristics of the cashew farmers; ascertained the area of losses in cashew production; ascertained postharvest management strategies used to minimize losses by cashew farmers and examined the constraints to the use of postharvest management strategies among the cashew farmers in the study area.

Hypothesis of the Study

Ho_1: The socio-economic characteristics of cashew farmers do not influence the number of postharvest management strategies adopted by the farmers in the area.

Methodology

The study was carried out in Imo State of Nigeria. The State is located in the South Eastern zone of Nigeria and lies between latitudes 5^{o} 45′N and 6^{0} 35′N of the equator and longitude 6^{0} 35′E and 7^{0} 28′ E of the Greenwich Meridian (Nigerian Meteorological Agency (NiMET), 2020). The State is bordered by Abia State on the East and Northeast, Rivers State on the South, Anambra State to the North and Rivers State to the South. Imo State is divided into three agricultural zones of Owerri, Orlu and Okigwe and 27 Local Government Areas. With a total land area of 5,530 Km^2, the State has an estimated population of about 4.8 million people and an annual growth rate of 3.35 percent (Nigeria Populations Commission (NPC), 2006). The cashew farmers in Imo State constituted the population for this study. Multistage sampling procedure was used to select seventy-two (72) cashew farmers for the study. Primary data were collected with

validated questionnaire. The data collected were analyzed with descriptive (frequency counts, percentages and mean) and inferential statistics (multiple regression analysis). The implicit form of the model was stated as follows:

$Y = f(X_1, X_2, X_4, X_5, X_6, X_7, X_8, X_9, e_i)$

Y = Postharvest management strategies (Total number of adopted management strategies)

X_1 = Age (years)

X_2 = Sex (Male = 1, Female = 0)

X_3 = Marital Status (Married = 1, Otherwise = 0)

X_4 = Household size (Number of persons)

X_5 = Educational (Number of years spent in school)

X_6 = Monthly income (Naira)

X_7 = Membership of cooperative (member = 1, non-member = 0)

X_8= Farming experience (Years)

X_9= Extension contacts (Number of visits)

e_i = error term

Results and Discussion

Socio-economic Characteristics of the Cashew Farmers

The result from Table 1 shows that mean age of the cashew farmers was 45.64 years. This indicates that most of the cashew farmers were mature and still active in cashew production. This result is in line with Pelemo et al. (2019) that cashew farmers in their prime age are favorable to cashew production since cashew farming requires intensive labor. Also, 75.59% were males; this indicates that males were more involved in cashew farming in the study area. The result suggests that stress involved in cashew production, male can be able to withstand more stress than female. Majority (73.61%) of the cashew farmers was married; this suggests that the cashew farmers were married people who are seen to be responsible according to family and social standards. The result also reveals that majority (86.11%) had secondary education. The finding implies that all the cashew farmers had attained one level of formal education which no doubt is expected to increases their literacy level. This is supported by the study of Egwuonwu, (2020) that farmers with higher education are more expose to relevant information on post-harvest management practices. The mean household size was 7 persons which implies that household size is expected to increase their access to farm labour in harvesting and processing of cashew. The mean years of farming experience was 19.25 years. Greater proportion (76.39%) of the cashew farmers in the area did not belong to any form of cooperative society. Majority (88.89%) of the cashew farmers did not have any contact with extension service for a while. This shows poor visits by extension agents in the area. This situation could pose a severe challenge to farmer in understanding best post-harvest management strategies to practice in cashew production in the area. The mean cashew trees owned by cashew farmers were 161 trees. The finding implies that they cultivated on a moderate farm size. The result shows that greater proportion (92.28%) did not have access to credit. Mohammed and Usman (2023) viewed that farmers access to credit will help them provide good quantity of farm produce. The mean annual income was ₦82,861.11. This suggests that the cashew producers in the study area were low-income earners. Mohamed and Nageye (2021) viewed that farmers who have income would make better decision, use necessary productive inputs efficiently to realize huge output.

Table 1: Socio-Economic Characteristics of the Cashew Farmers showing the dominating group

Variables	Dominating Category	Percentage	Mean
Age (Years)	41-50	61.84	**45.63 years**
Sex	Male	75.59	
Marital Status	Married	73.61	
Educational Level	Secondary	86.11	
Household Size	6-10	61.18	**7 Persons**
Member or cooperative	Non member	76.39	
Years of Experience	15-20 years	64.23	**19.25 years**
Extension Contact	Non-contact	88.89	
Access to credit	Non access	92.28	**161 trees**
Number of cashew trees owned	150 – 200	63.45	
Monthly Income	**₦50,001 -100,000**	52.37	**₦82,861.11**

Source: Field Survey Data, 2024

Area of Postharvest Losses in Cashew Production

Result in Table 2 shows that cashew farmers experienced losses mostly during the harvesting (97.2%) and processing stage (97.2%). They also experienced losses during the packaging stage (94.4%), storage (80.6%) and distribution/marketing stage (72%). This implies that losses occur at each stage if the farmers do not observe proper management strategies. This corroborates the views of Aluko et al. (2023) that high moisture content of cashew makes their handling, transportation, value addition and marketing a major challenge especially in Nigeria. The result further reveals that few (27.8%) of the cashew farmers observed losses during drying stage of the cashew nuts. This result is supported by Bharat (2022) that cashew nuts are dried to reduce the moisture content of the nut and also to mature the seed in the infrared and ultra-violet rays of the sun. This means that if cashew nuts are properly dried the losses will be minimized.

Table 2: Area of Postharvest Losses in Cashew Production

Area of Losses	*Frequency	Percentage
Harvesting stage	70	97.2
Processing stage	70	97.2
Packaging stage	68	94.4
Storage	58	80.6
Distribution/market stage	52	72.2
Drying stage	20	27.8

Source: ***Field Survey Data, 2024***

*Multiple responses were recorded

Postharvest Management Strategies Used to Minimize Losses by Cashew Farmers

The distribution of cashew farmers according to postharvest management strategies adopted to minimize losses was compiled in Table 3. Cashew farmers identified majorly postharvest management strategies as harvesting as soon as the fruits mature (95.8%), farm-gate sales immediately after harvest to reduce postharvest losses (93.1%). The finding is supported with Bharat (2022) that harvesting is the first step to be considered the first step in postharvest management and if the cashews are not properly harvested, losses will start from there, which may lead to both reduction in quality and quantity of cashew apple and the nuts. Also, use of available good road network for produce transportation (93.1%), use of adequate storage

facilities (93.1%), separating raw nuts from cashew apple immediately after harvest (91.7%) were post management practices adopted to reduce losses in cashew.
Furthermore, cashew farmers used sun in drying cashew nut for 4 to 7 days before storing in a container (87.5%). Drying of cashew nut is one of the very important practices in the post-harvest chain. Proper drying of nuts immediately after harvesting is necessary to retain the flavour and quality of the kernels (Priyashantha et al., 2020). Cashew fruit in spacious baskets and nut in air tight containers (87.5%), allowing cashew to mature and ripe before harvest (86.1%), use of adequate processing facilities (79.2%), use of proper harvesting techniques 79.2%), fumigation of the farm environment against pests and diseases (77.8%) and removal or discarding immature, diseased and damaged cashew nuts when drying (73.6%) were also identified by the cashew farmers as postharvest strategies adopted to minimize losses in cashew production.

Table 3: Postharvest Management Strategies Adopted to Minimize Losses by Cashew Farmers

Postharvest Management Strategies Adopted	*Frequency	Percentage
Harvesting as soon as the fruits mature	69	95.8
Use of adequate storage facilities	67	93.1
Farm-gate sales immediately after harvest to reduce PHLs	67	93.1
Use of available good road network for produce transportation	67	93.1
Separating raw nuts from cashew apple immediately after harvest	66	91.7
Packaging cashew fruit in spacious baskets and nut in air tight containers	63	87.5
Sun drying cashew nut 4 to 7 days before storing in a container	63	87.5
Allowing cashew to mature and ripe before harvest	62	86.1
Use of adequate processing facilities	57	79.2
Use of proper harvesting techniques	57	79.2
Fumigation of the farm environment against pests and diseases	56	77.8
Removal or discarding immature, diseased and damaged cashew nuts when drying	53	73.6

***Multiple responses recorded; Source: Field survey data, 2024**

Constraints to the Use of Postharvest Management Strategies among Cashew Farmers

The result of the cashew farmers' distribution based on constraints to using postharvest management strategies is shown in Table 4. The cashew farmers identified that the most important constraint in the usage of postharvest management strategies was poor extension contact (98.61%). Also, poor storage facilities (97.22%), poor processing facilities (95.83%), high cost of postharvest management equipment (95.83%), and inadequate knowledge of the use of modern postharvest technologies (94.4%) were identified by cashew farmers as constraints to the usage of good postharvest management strategies. This supports the findings of Ogunwolu et al. (2024) who reported that lack of processing and storage facilities were the significant constraints affecting cashew production in Nigeria. This constraint is well pronounced in Nigeria compared to other advanced countries using cashew apples. This finding agrees with Pelemo et al. (2019), who also reported that despite the increase in cashew production in Nigeria, only the cashew nuts are presently being utilized in the processing industry, whereas the cashew apple wastes away. Furthermore, high cost of transportation (94.4%), high pest and disease infestation (91.67%), microbial actions (84.72%), poor road infrastructure (80.56%) were also constraints faced by cashew farmers in using postharvest management strategies.

Table 4: Constraints to the Use of Postharvest Management Strategies among Cashew Farmers

Constraints	*Frequency	Percentage
Poor extension contacts,	71	98.61
Poor storage facilities	70	97.22
Poor processing facilities	69	95.83
High cost of postharvest management equipment	69	95.83
Inadequate knowledge of the use of modern postharvest technologies	68	94.44
High cost of transportation	68	94.44
High pest and diseases infestation	66	91.67
Microbial actions	61	84.72
Poor road infrastructure	58	80.56
Vagaries of weather and environment (climate change)	31	43.06
Inadequate education	14	19.44

***Multiple responses recorded; Source: Field survey data, 2024**

Relationship between the Cashew farmers Socio-economic Characteristic and Number of Postharvest Managements Strategies Adopted

Table 5 shows the result of the relationship between cashew farmers socio-economic characteristics and the number of postharvest management strategies adopted in cashew production. The study reveals that the values of coefficient of multiple determination (R^2) = 0.643 and F-ratio value = 12.420 were significant at 1% probability level. This indicates that 64.3% of the variation in a number of postharvest management strategies adopted in the study area was clearly and jointly explained by the explanatory variables, while the remaining 35.7% was accounted-for due to stochastic term (error term). This indicates that there was significant relationship between cashew farmers' socio-economic characteristics and postharvest management strategies. This study, therefore, rejects the null hypothesis that there is no significant relationship between the socio-economic characteristics of the cashew farmers and the postharvest management strategies adopted in the study area.

Table 5: Multiple Regression Analysis of Relationship between Cashew farmers Socio-economic Characteristic and Number of Postharvest Managements Strategies Adopted

Explanatory Variables	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.020	0.018		1.071	.289
Sex	0.000	0.005	0.004	0.056	.955
Age	0.001	0.000	0.156	1.503	.138
Marital Status	0.018	0.006	0.307	3.124	.003**
Educational Level	0.002	.001	0.208	2.497	.015*
Farming Experience	-0.004	.001	0.485	4.376	.000**
Household Size	0.002	.001	0.150	1.507	.137
Cooperative Member	0.035	.005	0.595	6.915	.000**
Extension Contact	.020	.005	0.327	3.722	.000**
Monthly Income	4.521E-008	.000	0.267	3.201	.002**
R^2 =0.643					
F- ratio = 12.420; p< 0.01					

Note: *p< 0.05, *p< 0.01; Field Survey, 2024

Conclusion

Cashew farmers in the study area experienced great postharvest losses and majority of the postharvest losses in cashew production was caused by inadequate processing facilities. Cashew farmers practiced better postharvest management such as harvesting as soon as the fruits mature and farm-gate sales immediately after harvest to reduce postharvest losses. The farmers were majorly constrained by poor extension contact. poor storage facilities, poor processing facilities, high cost of postharvest. Also, marital status, educational level, farming experience, cooperative member, extension contact and annual income influenced the number of postharvest management strategies adopted by the cashew farmers.

Recommendations

Based on the findings, the following recommendations are made.

1. Extension agents should get in touch with cashew farmers to help them to reduce postharvest losses. Also to provide farmers with relevant information on improved and modern techniques of postharvest management.
2. Cashew farmers in Imo state at large should be encouraged to form cooperatives as this would enhance them to share and get relevant information on how to reduce post-harvest losses in their cashew production.

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