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EFFECT OF POST-HARVEST LOSS MANAGEMENT STRATEGIES ON THE FOOD SECURITY STATUS OF COWPEA FARMING HOUSEHOLDS IN KOGI STATE, NIGERIA.

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ABSTRACT

Effect of post-harvest loss management strategies on the food security status of cowpea farming households in Kogi State, Nigeria was the focus of this work. Multistage sampling procedure was used to select 250 farmers across the agricultural zones of the State. Descriptive statistics, Household Food Insecurity Access Scale (HFIAS) and binary logit regression were used to analyze the collected data. The results showed that sun drying (93%), timely harvesting (88%), and timely marketing (78%) were the most commonly used post-harvest loss management strategies. Findings further revealed that majority of the households were food insecure. Binary logit results indicated that post-harvest loss incidence ($p < 0.01$), household size ($p < 0.01$), gender ($p < 0.05$), and age ($p < 0.01$) negatively influenced food security, while cowpea income ($p < 0.01$) and farming experience ($p < 0.01$) had positive and significant effects on the food security of households. However, post-harvest loss management strategies were not significant. The study concludes that mere use of post-harvest loss management strategies does not guarantee improved food security conditions for the households in the study area. The study recommends that structural frameworks and policies that will Promote the appropriate and efficient use of post-harvest loss management strategies coupled with requisite training, credit and institutional support in other to reduce the incidence of post-harvest losses in the study area.

Keywords: Food Security, Post-harvest Losses, Management Strategies, Binary Logit, , HFIAS.

INTRODUCTION

The agricultural sector in Nigeria continues to be an important contributor to Nigeria's economy through providing employment, income, food, and raw materials to a large portion of the population. Rural-based employment and income generation as a result of agricultural activities are also very significant in terms of overall national development. Smallholder farming households benefit most of all from agriculture-related activities. However, despite the role that agriculture plays in Nigeria's economy, food insecurity is still a major challenge among rural farming communities in Nigeria. This may not be unconnected with productivity-related issues and food wastage leading to post-harvest losses. Post-harvest losses are now increasingly seen to be an important factor in food security, as they directly affect the availability, access and use of food in developing countries like Nigeria (Ogundele, 2022).

Post-harvest loss relates to the quantity and quality of agricultural output being lost after harvest but before eating. Post-harvest loss can occur during the stages of harvesting, threshing, drying, moving to market, processing, storing, and marketing. Many smallholder farmers in rural Nigeria experience significant post-harvest losses due to a combination of worsened access to modern forms of temperature control (such as refrigerators) to preserve food, engagement of poor post-harvest handling methods, pests, and insufficient transportation systems (Ibrahim et al., 2022). Collectively, these losses lead to decreased quantities of food available for consumption and sale, reduced income from agricultural production, and increased risk to food security for households that are primarily reliant on agriculture to meet their basic needs.

Cowpea (Vigna unguiculata), one of the two most significant grain legume crops grown in Nigeria, is also considered the most important legume crop cultivated in Sub-Saharan Africa. It is highly prized for its many benefits, including nutritional value, economic impact, and agronomic value. For hundreds of thousands of families, particularly those in low-wage rural areas, cowpeas provide an economical source of protein, vitamins, minerals, and energy. Nigeria is the world's largest producer and consumer of cowpeas, with millions of families relying on this crop to provide both food and income (Mohammed et al., 2021). In addition to its nutritional benefits, cowpeas promote soil fertility by fixing nitrogen and are crucial components of sustainable agricultural systems.

Irrespective of cowpea's relevance among farming households in Nigeria, there are many post-harvest incidents of trouble with cowpea production in Nigeria. The cowpea grain is very susceptible to various insect pests, especially cowpea bruchids (*Callosobruchus maculatus*), which result in high qualitative and quantitative losses of cowpea grains during storage. The aforementioned problems are related to the poor quality of drying, poor quality of storage structures, poor quality of packaging, and poor quality of transportation. Research has shown that post-harvest losses of cowpea negatively impact income to households, the amount of food available for consumption within the households, and the market value that a household can get from cowpea, which ultimately leads to an increased level of food insecurity for farming households (Abdullahi et al. 2025).

Multiple approaches have been suggested to avoid loss after harvest through management practices that promote proper methods of harvesting, drying, threshing, handling, and storing produce using various forms of storage technology such as Purdue Improved Crop Storage (PICS). The use of hermetic storage technologies has been the most notable of these, given its capacity for effectively reducing insect infestations while reducing the use of harmful chemicals. Studies have shown that improved hermetic storage technologies reduce post-harvest loss while increasing food security and the overall welfare of smallholder cowpea farmers (Arouna, et al., 2023).

There has been empirical research that verifies how good post-harvesting management improves the household's wealth as well as the security of the food supplied to that household. Otitoju and Olawoye (2025) researched households of cowpea farmers in Niger and Nasarawa States using data from cowpea farmers to show that reducing post-harvesting losses could result in households having increased income and reducing their losses related to storing these products. Recent data from Nigeria showed that families who experienced high rates of post-harvesting loss typically had reduced amounts of food diversity and experienced a greater risk of food shortage. However, households that improved their management of post-harvesting loss experienced more stable food availability, and consequently, more stable household welfare (Adewale et al. 2026).

Food security occurs when every individual has reasonable access to sufficient amounts of nutritious foods to lead an active and healthy life. Despite being involved with growing food directly, many farming families in Nigeria endure the burden of food insecurity. This isn't because there isn't enough fixed food supply available; it's because there have been significant amounts of food wastage caused by improper handling after harvest. Therefore, improving upon how crops are handled after harvesting is one sure way to create long-term food security for rural families. (Ogundele, 2022)

Kogi State, Nigeria, has rich agricultural production and good ecology for cowpea production. Many rural residents of Kogi State rely on agriculture for their food supply and livelihood. Cowpea farmers in Kogi State experience several issues from the point when they have harvested their crops, including poor storage facilities and limited access to better ways to preserve cowpeas. This exacerbates the volume of cowpea wastage or losses in the study area. These issues may greatly affect how food secure a cowpea farmer's family will be. There are many papers discussing post-harvest losses and food insecurity in Nigeria. The number of research articles that have looked at the impact of post-harvest management techniques on the level of food insecurity in the homes of cowpea farmers in Kogi State is all too few.

The objective of this research is to analyse how post-harvest management strategies affect the food security of the households that cultivate cowpeas in Kogi State, Nigeria. The goals of the analysis are threefold: To identify how cowpea farmers are managing their crops after harvest (post-harvest management); to assess how food secure or insecure these households are (food security assessment); and finally, to determine the effects of each of these strategies on the food security of the households being studied. The results of the analysis should be of great assistance to various groups, including policymakers, extension agents, development organizations, and researchers, as they design appropriate interventions that will help lower post-harvest losses and improve food security for rural farmers within Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Kogi State, Nigeria, located within the Guinea Savannah ecological zone. The State capital, Lokoja, lies at the confluence of Rivers Niger and Benue, which gives Kogi State its popular name, "The Confluence State." The State lies between latitudes 6°30′N and 8°50′N and longitudes 5°51′E and 7°49′E, covering approximately 29,833 km². Kogi State is well known for producing major food crops such as yams, cassava, maize, rice, millet, sorghum, cowpea, groundnut, pigeon pea, melon, and vegetables. The climatic conditions and fertile soils make the state suitable for cowpea production and other arable farming activities.

Sample Procedure and Sample Size

The study population comprised all registered cowpea farmers under the Kogi Agricultural Development Project (KADP), with a total sampling frame of 2,507 farmers across the state's four agricultural zones.

A multi-stage sampling procedure was employed. In the first stage, one Local Government Area (LGA) was randomly selected from each of the four agricultural zones. In the second stage, four communities were randomly selected from each selected LGA, giving a total of sixteen communities. In the third stage, proportionate sampling was used to allocate respondents according to the distribution of farmers across the zones as shown on Table 1. This gave a total of 250 respondents which were used for analysis

Table 1: Showing the Sample distribution of the cowpea in the study area

Agricultural Zones	LGA	Sample frame	Sample Size
A (Aiyetoro-Gbede)	Ijumu	625	62
B (Anyigba)	Dekina	847	85
C (Kotonkarfe)	Koton Karfe	477	47
D (Alloma)	Idah	558	56
Total		2507	250

Source: Kogi State Agricultural Development Project (KADP), 2024

Data Collection

Primary data were collected using a structured questionnaire supported with interview schedules for respondents with limited formal education. Information collected included socio-economic and institutional characteristics, post-harvest loss management Strategies, household food security status, and constraints faced by farmers.

Method of Data Analysis

Both descriptive and inferential statistics were used for data analysis.

Food security status was measured using the Household Food Insecurity Access Scale (HFIAS) developed by the Food and Nutrition Technical Assistance (FANTA) project. The HFIAS consists of nine occurrence questions with frequency of occurrence responses scored as:

0 = No occurrence
1 = Rarely
2 = Sometimes
3 = Often
The household responses were classified into 4 groups using the HFIAS algorithm:
1. Food security – 0-4
2. Mildly food insecure - 5-7
3. Moderately Food Insecure - 8-10
4. Severely Food Insecure - 11-16
Households were classified into food security categories based on their scores. For binary logit estimation, the categories were collapsed into:
Food secure (Food secure + Mildly food insecure) = 1
Food insecure (Moderately + Mildly food insecure + Severely food insecure) = 0

This implies that households with adequate or slightly constrained access to food were classified as food secure (1), while households facing moderate to severe food shortages were classified as food insecure (0).

Binary Logit Regression was used to determine the effect of post-harvest loss management strategies on household food security status.

The model is expressed as: The implicit form of the model is expressed as:

$Y_i=f(X_1, X_2, X_3……..., X_{18}) + \varepsilon i$
Where:
Y_i = Food security status of the i^{th} household
(1 = Food secure, 0 = Food insecure)
The explicit form of the model is given as:

$$1n\left(\frac{Pi}{1-Pi}\right) = \beta_0 + \beta_1X_1 + \ldots\ldots\ldots + \beta_{18}X_{18} + \epsilon_i$$

Where,
P_i = Probability that the household is food secure
$1 - P_i$ = Probability that the household is food insecure
β_0 = Constant term
$\beta_1 – \beta_{18}$ = Variables to be estimated
ϵ_i = Error term

Variables;

X_1 = Sun drying
X_2 = Chemical usage
X_3 = Airtight container
X_4 = Smoking
X_5 = Timely Marketing
X_6 = Timely Harvesting
X_7 = Amount lost to PH
X_8 = Incidence of PHL
X_9 = Cowpea income
X_{10} = Credit access
X_{11} = Extension Contact
X_{12} = Cooperative membership
X_{13} = Farming experience (years)
X_{14} = Farm size (ha)
X_{15} = Household size
X_{16} = Formal education
X_{17} = Gender
X_{18} = Age
ϵ is the error term

RESULTS AND DISCUSSION
Socio-Economic Characteristics of Respondents

The socio-economic characteristics of cowpea farming households in Table 2 showed that the mean age of respondents was 47 years, indicating that most farmers were in their economically active and productive years. This suggests that cowpea farming in the study area is dominated by middle-aged farmers who possess considerable farming

experience and decision-making capacity. Agada and Ijih (2019) assert that a larger proportion of farmers in Benue state are within the active productive stage. This may influence their readiness to adopt innovation and acquire new skills and knowledge across all aspects of post-harvest management to improve income and livelihoods. The study further revealed that 73.6% of respondents were male and 26.4% were female, indicating male dominance in cowpea production activities. This may be attributed to land ownership patterns and labour requirements associated with cowpea farming. However, women still play a significant role in agriculture and postharvest activities in Nigeria. This in line with Emmanuel, (2019) and Chikwendu and Arokoyo (1997).

Table 2: Distribution of the Socio-economic Characteristics of the Respondents

Socio-economic Variables	Frequency	Percentage (%)	Mean/Mode
Age			
20-29	4	1.6	
30-39	41	16.4	
40-49	89	35.6	47
50-59	80	32	
Above 60	36	14.4	
Gender			
Male	184	73.6	Male
Female	66	26.4	
Educational Qualification			
No formal education	59	23.6	
Primary	60	24	
Secondary	103	41.2	Secondary
Tertiary	28	11.2	
Household Size			
1-5	59	23.6	
6-10	178	71.2	
Above 10	13	5.2	7 Persons
Farm Size (ha)			
0-1	4	1.6	
1-2	240	96	
Above 2	6	2.4	
Farming Experience (Years)			1.5 ha
1-10	46	18.4	
11-20	92	36.8	
21-30	80	32	20
Above 30	32	12.8	
Cooperative Membership			
Yes	219	87.6	
No	31	12.4	
Extension Contact			
Yes	116	46.4	Yes
No	134	53.6	
Access to Credit			
Yes	121	48.4	
No	129	51.6	No
Total	250	100	

Source: Field Survey Data, 2025

The majority (41.2%) of the respondents had secondary education, which shows a moderate literacy level among the farmers. Education increases the capacity of farmers to understand and adopt improved post-harvest technologies and management practices. Manda *et al.* (2020) reported that educated farmers are more likely to understand safe chemical application and improved storage methods. Education improves access to information, risk assessment ability, and

responsiveness to extension training. Household size was relatively large, with about 71.2% of respondents having between 6 and 10 household members and a mean household size of 7 persons. A large household size might imply more labour for post-harvest activities. Liverpool-Tasie *et al.* (2020), however, argued that larger households may also increase consumption pressure, forcing farmers to sell early before proper storage. Farm size distribution showed that 96.0% of respondents cultivated between 1 and 2 hectares, with a mean farm size of 1.5 hectares, confirming the smallholder nature of cowpea production in the study area. Sisay (2022) found that farm size impedes post-harvest crop handling, as larger farms adopt improved technologies and have lower post-harvest loss rates.

Most farmers (36.8%) had 11-20 years of experience; 32% had 21-30 years; 18.4% had 1-10 years; and 12.8% had more than 30 years. The average farming experience of about 20 years indicates substantial indigenous knowledge that aids the handling of produce after harvest. But, without adequate access to extension services and modern storage technologies, experience alone may not be enough to reduce post-harvest losses (McNamara & Tata, 2015). Most respondents (87.6%) belonged to cooperative societies, which could enhance access to credit, information, and improved technologies. Verhofstadt & Maertens (2015) showed that cooperative participation significantly improves access to training, credit, and post-harvest technologies in African smallholder systems. However, only 46.4% had access to extension services, while 48.4% had access to credit facilities, indicating institutional constraints that may affect the adoption of improved post-harvest management strategies.

Post-Harvest Loss Management Strategies Utilised by Cowpea Farmers

Table 3 showed that the most commonly utilised post-harvest loss management strategy was sun drying (93.0%), followed by timely harvesting (88.0%) and timely marketing (78.0%). Use of storage chemicals accounted for 60.0%, while smoking (44.0%) and storage in airtight containers (43.0%) were moderately adopted. Abdulai and Huffman (2019) suggest that the adoption of low-cost agricultural technologies is significantly higher among smallholders than among capital-intensive innovations. Their findings imply that farmers tend to choose practices that align with their financial capacity and risk preferences, which may explain the overwhelming reliance on sun drying in this study.

However, the use of improved storage bags (19.0%), natural repellents (19.0%), mechanical drying (2.0%), and value addition (2.0%) was very low. This suggests that farmers still rely heavily on traditional post-harvest management practices rather than improved modern technologies.

Low adoption of improved storage technologies may be due to high costs, poor awareness, limited access to inputs, and inadequate extension services. This finding is consistent with previous studies reporting low adoption of hermetic storage technologies among smallholder cowpea farmers in Nigeria.

Table 3: Distribution for Post-harvest Loss Management Strategies Utilized by Cowpea Farmers

Strategies	Frequency	Percentage (%)	Ranking
Sun Drying	233	93	1st
Timely Harvesting	219	88	2nd
Timely Marketing	196	78	3rd
Use of Storage Chemicals	149	60	4th
Smoking	111	44	5th
Storage in Airtight Containers	107	43	6th
Sorting and Grading	59	24	7th
Use of Improved Storage Bags	48	19	8th
Natural Repellent	47	19	9th
Use of Moisture Absorbers	11	4	10th
Mechanical Drying	6	2	11th
Value Addition	4	2	11th
	n = 1190**		

Source: Field Survey Data, 2025 **Multiple responses

Effect of Post-Harvest Loss Management Strategies on Food Security Status of Cowpea Farming Households in Kogi State

Table 4a presents the collapsed result of the FANTA food security categorization into food secure and food insecure. The result was revealed. That only 22.8% of the respondents were food secure, while 77.2% were food insecure. This indicates a high prevalence of food insecurity among cowpea farming households in Kogi State despite their involvement in food production.

This result suggests that engagement in agricultural production alone does not guarantee household food security when substantial post-harvest losses reduce available food and marketable surplus. Poor storage systems, unstable income, and high household dependency ratios may worsen food insecurity among farming households. This result corroborates the findings reported by Toluwase *et al.* (2020) on the food insecurity status of rural households in Ekiti State, with 83.6% of households classified as food insecure.

Table 4a: Distribution of Food Security Status of Cowpea Farming Households in Kogi State

FOOD SECURITY SCORE	FREQUENCY	PERCENTAGE (%)
FOOD SECURE	57	22.8
FOOD INSECURE	193	77.2
TOTAL	250	100

Source: Field Survey Data, 2025

The binary logit regression results in Table 4b showed that the model explained household food security status well, with a Pseudo R^2 of 0.5573. This means the explanatory variables captured a significant part of the variation at 55.73%. The results made it clear that managing post-harvest losses plays a vital role in boosting food security for families that farm cowpeas. The results showed that post-harvest loss incidence negatively affects food security at the household level ($p < 0.01$), meaning households that suffer from a greater level of post-harvest loss breakfast were less likely to experience food insecurity. As such, post-harvest losses are likely reducing the amount of food available for both household consumption and for sale. This is consistent with Affognon et al.(2020)'s study, which found a direct relationship between post-harvest losses and reduced availability of food and reduced agricultural income in Sub-Saharan Africa.

Cowpea income positively and significantly influenced food security ($p < 0.01$), suggesting that increased income from the sales of cowpea output improves the households' capacity to acquire food in other to meet basic household needs. This finding is consistent with Ogutu *et al.* (2020), who reported that agricultural commercialization and higher farm income conspicuously improve household nutrition outcomes. Farming experience also had a positive and significant effect on cowpea household food security at ($p < 0.01$), this implies that experienced cowpea farmers are better positioned to manage production and post-harvest activities effectively. This finding is consistent with the findings by Danso-Abbeam *et al.* (2018), who found that experience in farming significantly improves productivity and income outcomes. Household size exhibit a negative and significant effect on food security ($p < 0.01$), showing that households with larger population face greater consumption pressure and are more likely to food insecurity. Ogunniyi *et al.* (2022) reported that household with large population experience more burdens with regards to household expenditure and are more vulnerable to food consumption shortfalls.

Gender of cowpea producing households was negative and significant to their food security conditions. The negative coefficient is indicative of the fact that gender gaps impact food security in cowpea farming households. Male-headed households in the study area usually get better access to land, labour, and finance than those led by women. Women are often challenged with more limited access to inputs, support, and credit and this pose an issue to their involvement in cowpea production. Age also exert a negative and significant effect on the food security condition of the respondents. This implies that as cowpea farmers get older, their households tend to be less food secured. Taking of risks or try new post-harvest technologies is usually a challenge among aged farmers because they struggle with declining physical strength. In contrast, younger farmers usually adapt more quickly and show greater openness to modern agricultural methods. This matches what Obayelu (2012) who found that older farmers are less likely to embrace new innovations that can boost productivity and improve food security. Key variables of post-harvest loss management strategies like sun drying, chemical use, airtight storage, smoking, timing of marketing and harvest were not significant during the period of this study, this suggests that mere use of post-harvest loss management strategies does not guarantee improve food security conditions for cowpea farming households. The way and manner this strategies are being used is of great concern. Akintola and Fakoya (2017) pointed out that outdated post-harvest strategies are usually inefficient as a result of lack of proper storage, limited processing facilities, and inadequate technical skills among the farmers. The Food and Agriculture Organisation (FAO, 2019) also noted that traditional preservation techniques offer smallholder farmers only minimal protection against post-harvest loss. Affognon et al (2023) also demonstrated that simply handing out better post-

harvest technologies to farmers does not yield good result unless farmers receive training, have access to credit with strong institutional support.

Table 4b: Binary Logit Regression Estimates of the Effect of Post-harvest Loss Management Strategies on the Food Security Status of Cowpea Farming Households

Variables	Coefficient	Std. Error	Z-value	P-value
Sun Drying	-0.141	0.715	-0.20	0.843
Chemical Usage	-0.397	0.519	-0.76	0.445
Airtight Container	-0.597	0.501	-1.19	0.234
Smoking	0.135	0.463	0.29	0.770
Timely Marketing	-0.270	0.586	-0.46	0.645
Timely Harvesting	0.064	0.740	0.09	0.931
Amount lost to PH	-0.000	0.000	-1.59	0.112
Incidence of PHL	-1.520***	0.500	-1.59	0.002
Cowpea income	0.000***	0.000	5.09	0.000
Credit access	-0.180	0.476	-0.38	0.706
Extension contact	0.130	0.521	0.25	0.803
Cooperative membership	0.021	0.791	0.03	0.979
Farming experience (years)	0.168***	0.032	5.22	0.000
Farm size (ha)	-0.035	0.171	-0.21	0.837
Household size	-0.339***	0.129	-2.62	0.009
Formal education	0.163	0.549	0.30	0.766
Gender	-1.334**	0.559	-2.39	0.017
Age	-0.081***	0.027	-2.96	0.003
Constant	4.165**	2.116	1.97	0.049
No of Observation = 239	Log Likelihood = -68.036	LR Chi^2 (18) = 171.31		
Prob > Chi^2 = 0.000		Pseudo R^2 = 0.5573		

***, ** and * represent significance at 1%, 5% and 10% respectively
Source: Field Survey Data, 2025

CONCLUSION

This study considered the effect of post-harvest loss management strategies on the food security status of cowpea farming households in Kogi State, Nigeria.

With reference to the socioeconomic characteristics of cowpea farming households in rural Kogi State, it was found that the crop is dominated by male farmers who are economically active , with considerable farming experience but limited access to credit and extension services

The findings on the type of post-harvest management strategies utilized in the study area showed that most farmers still depend largely on traditional practices such as sun drying, timely harvesting, and timely marketing, while the use of improved post-harvest management strategies remains relatively low

The study also revealed that a large proportion of cowpea farming households were food insecure despite being actively involved in food production. The binary logit analysis showed that a higher incidence of post-harvest losses significantly reduced the chances of households being food secure, while higher income from cowpea production and longer farming experience improved food security outcomes. Larger household size, gender and age were found to reduce the likelihood of the household being food secured.

The study, therefore, concludes that mere use of post-harvest management strategies does not guarantee improve food security conditions for cowpea farming households in the study area as at the time of this research. The way and manner this strategies are been used is of great concern. This scenario resulted in higher incidence of post-harvest losses significantly reducing the chances of households being food secure. The study recommends that structural frameworks and policy that will engender the appropriate and efficient use of post-harvest

management strategies coupled with requisite training, credit and institutional support in other to reduce the incidence of post-harvest losses in the study area.

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