ANALYSIS OF POST-HARVEST HANDLING PRACTICES AMONG HOME-GROWN RICE FARMERS IN FEDERAL CAPITAL TERRITORY (F.C.T.), ABUJA, NIGERIA

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ABSTRACT

The study was carried out to analyze the post-harvest handling practices among home-grown rice farmers in Abuja, Nigeria. The objectives of the study include description of socio-economic characteristics of rice-farmers in the study area, identify major causes of post-harvest losses among the home-grown rice farmers, examine the relationship between the socio-economic characteristics of rice-farmers and the post-harvest handling practices adopted by them, identify the constraints to post-harvest handling practices in rice production in the study area. Multi-stage sampling technique was used for sample selection. Primary data was used for the study which was collected using a well-structured questionnaire from 300 respondents out of the three area councils purposively selected from six area councils. The study revealed that pest infestation was the most prevalent cause of rice postharvest losses as indicated by 95% of the respondents. The chi-square result of the relationship between socio-economic characteristics and adoption of rice post-harvest handling practices in the study area revealed that farming experience and membership in cooperative society were significant at 1% probability level, marital status was significant at 5% while the level of education was significant at 10% probability. The study, however, revealed that the effect of climate change is the biggest constraint or challenge rice farmers in the study area faced while engaging in rice post-harvest activities. The study recommended that training programs and workshops be organized to educate farmers on best practices in post-harvest handling, including training on proper drying, proper milling, and storage processes.

Keywords: Rice, home-grown, post-harvest handling, analysis.

INTRODUCTION

Rice (*Oryza sativa*) is a staple food and a vital source of nutrition for a significant portion of the global population, particularly in Nigeria (Folorunso *et al*., 2016). As one of the most important cereal crops, rice contributes to food security, rural livelihoods, and economic development in many countries. In Nigeria, rice is a staple in the diets of millions of people, making it a crucial agricultural commodity with both subsistence and economic significance (Nwite, 2014). Rice (*Oryza sativa*) is one of the most frequently cultivated cereal crops in the world and is regarded as one of the most significant food crops by about half of all people (IRRI, 2009). It is regarded as one of the most significant staple foods for over half of the world's population and ranks third in global output behind wheat and maize (Ajala and Gana, 2015).

The most crucial calorie source for humans is rice. When it comes to cereals, rice is primarily farmed for human consumption, with relatively little being used for other purposes. Rice accounts for about 21% of global per capita calorie intake and 27% of per capita calories in poor nations (Awika *et al.,* 2011). In Nigeria, it has become a staple dish that is consumed in large quantities by all households, including those with wealth and poverty (Godwin, 2012).

The structural rise in rice consumption over the years, with consumption spreading across all socioeconomic strata, including the poor, appears to have been caused by a confluence of different variables. Rising demand is a result of rising income levels and population increase, as well as the simplicity with which it may be prepared and stored (GAIN, 2012). Rice has gone from being a luxury to a need whose consumption will rise along with per capita GDP growth in Nigeria (Ojogho and Alufohai, 2010). As a result, rice's significance as a key food item for food security will rise along with economic expansion.

Nigeria's major annual crop is rice. It is one of the main cereal crops that can give a population of a country the minimal amount of daily calories needed for food security, which is 2,400 (Olagunju, 2014). Since 1970, the demand for rice has grown more quickly than domestic production and more than in any other African nation because of its growing proportion to Nigerians' capital calorie consumption (FAO, 2011). Rice is grown nationwide and in all agro-ecological zones, from Sahel to the coastal swamps (Amponsah *et al.,* 2018). Owing to the increasing contribution of rice to the per capital calories consumption of Nigerians, demand for rice has been increasing much faster than domestic production and more than in any other African countries, since the mid-1970s (Bamidele *et al.,* 2010).

Federal Capital Territory has experienced an increased interest in rice farming in recent years. The city's strategic location and growing population have prompted some farmers to engage in rice cultivation to meet local demand (Sennuga *et al.,* 2021). However, as the focus has predominantly been on increasing production, the aspect of post-harvest handling has often been overlooked. Effective post-harvest handling practices are critical for reducing losses, ensuring food safety, maintaining product quality, and enhancing farmers' income (Elik *et al.,* 2019). These practices include threshing, drying, cleaning, storage, and transport of the harvested rice grains. Unfortunately, many home-grown rice farmers in the Federal Capital Territory may lack access to proper knowledge about post-harvest handling practices and resources for implementing efficient post-harvest handling techniques. Traditional methods that are less effective and more prone to losses might still be prevalent due to limited awareness of modern techniques (Fakayode, 2009).

Post-harvest loss is defined as the deterioration of food production's quantity and quality from harvest to consumption (Kitinoja and Gorny, 2010). This suggests that post-harvest loss includes rice quality decline as well as reduction in quantity. Rice processing or post-harvest treatment involves a number of procedures, including husk removal, milling the shelled rice to remove the bran layer, and an additional whitening step to match market expectations for the appearance of the rice kernels. The phase of crop production that comes right after harvest is known as post-harvest handling. Post-harvest management practices in rice are the various handling, packaging and treatment that the grain undergoes before consumption. The instant a crop is removed from the ground, or separated from its parent plant. Post-harvest operation or handling in rice begins when the panicle is separated from the rice plant at harvest, harvesting is often considered the starting point of the post-harvest handling. These handling processes as mentioned earlier include cleaning, drying, threshing, milling and storage etc. (Oguntade *et al.,* 2014). Harvesting activities also include all operations carried out in the field which include cutting the rice stalk or reaping the panicles, either laying out the paddy-on-stalk or stalking it to dry, and bundling for transport.[1]

Post-harvest technologies are developed and introduced purposely to reduce post-harvest losses and bring about improvement in crop handling. The objectives of applying post-harvest technology are crucial because they include: maintaining food quality (appearance, texture, flavour and nutritive value), food safety, and reducing losses between harvest and consumption. It is equally essential to see how locally produced rice are handled after harvesting from the field (Qamar *et al.,* 2015). Against this background, this study seeks to assess post-harvest handling practices by locally produce rice farmers in the Federal Capital Territory with the aim of reducing to the barest minimum post-harvest losses or eliminating post-harvest losses completely if possible.

Therefore, the specific objectives of the study were to describe the socio-economic characteristics of rice farmers in the study area, identify major causes of post-harvest losses among the home-grown rice farmers in the study area, examine the relationship between the socio-economic characteristics of the farmers and the post-harvest handling practices adopted by them and identify the constraints to post-harvest handling practices in rice production in the study area.

The null hypothesis tested was that there is no significant relationship between the socio-economic characteristics of the home-grown rice farmers and the post-harvest handling practices adopted by the rice farmers in the study area.

RESEARCH METHODOLOGY

The study was carried out in the Federal Capital Territory (FCT), Abuja, Nigeria. FCT is located between latitudes 8° 25' and 9° 25', North of the equator and longitudes 6° 45' and 7° 45' East of the Greenwich meridian. It is located in the middle belt of Nigeria and its size is equivalent to 0.85% of Nigeria and is bordered by four states namely: Kogi, Nassarawa, Kaduna, and Niger. The FCT is made of six area councils (AMAC, Gwagwalada, Bwari, Kuje, Kwali and Abaji). Abuja is geographically located in the center of the country. The territory covers an area of 8,000 km² (Balogun, 2001). FCT experiences two weather condition in the year. These are the rainy season which begins around May and runs through October, the dry season (usually characterized by bright sunshine) which begins from October and ends in April. The average annual rainfall is about 1,256mm per annum. The temperature in the FCT ranges between 30°C to 37°C yearly with average temperature of 27.3°C. It is situated within the Guinean forest-savanna region with moderate climatic conditions. The indigenous inhabitants of Abuja are the Gbagyi and that is the major language while others include Bassa, Gwandara, Gade, Ganagana and Koro. The major stable crops grown in the area includes; cassava, yam, sweet potato, sorghum, maize, millet, onions, tomatoes, pepper, rice, groundnut, cowpea, etc. The population is estimated to be about 3,095,000 people in 2019 which is about 6.039% increases from 2018 (Macrotrend, 2020). Three out of the six zones have been purposefully sampled, namely; Abaji, Gwagwalada, and Kwali due to large concentration of rice farmers in these zones (FMARD, 2018), purposefully chosen means the choice is with bias to places that have large concentration of rice farmers. Due to the types of parent materials that underlay the FCT, the FCT has the following types of soils; Gley soils (very fertile and found in Abaji, comb soils.[7] In order to sample respondents for the study, a multi-stage sampling technique was used. Out of the four agricultural zones in the Federal Capital Territory, three (3) were purposefully chosen at the initial stage. In the second step, five (5) blocks were chosen from each of these zones, for a total of fifteen (15) blocks. In the third stage, two (2) cells were chosen from each block, resulting in a total of 30 blocks. Finally, ten (10) respondents were chosen from each of the cells. The study's total number of respondents was 300. The researcher used primary data for the study, which were collected using a well-structured questionnaire that were distributed to rice farmers in the study area by well-trained ADP enumerators who are familiar with the area. The field data was analyzed using SPSS 23. After analysis, the research results were categorized based on the objectives of the study and presented using tables. To perform a chi-square test, you calculate the chi-square statistic and compare it to a critical value from the chi-square distribution with a certain degree of freedom. If the calculated chi-square statistic is greater than the critical value, you reject the null hypothesis and conclude that there is a significant association (in the case of the chi-square test of independence) or that the observed distribution does not fit the theoretical distribution (in the case of the chi-square test of goodness of fit).

$$X^2 = E \frac{(O_i - O_i)^2}{E}$$

Where E_i is expected value
O_i is observed value

RESULTS AND DISCUSSION

A. *Socio-Economic Characteristics of Respondents in the Study Area*

Presented in Table 1 is the result for the socio-economic characteristics of the rice farmers in the study area. The result revealed that most (61.5%) of the farmers were male while only 38.5% of them were female. This is in line with the findings that because men can engage in more physically demanding tasks, they are more involved in agricultural production than women (Idu *et al.,* 2020). The result further revealed that 62.7% of the farmers were married, 28% were single, 5.3% of the respondents were widowed while the remaining 2% were divorced. This result aligns with the findings that most of the rice farmers in their study on the utilization of agricultural information and knowledge were married (Adetimehin *et al.,* 2018). Agriculture is often a family-centric occupation, and farming activities are passed down through generations. In many cases, married individuals inherit or continue family farming traditions, contributing to a higher percentage of married farmers. Marriage often involves economic partnership and shared responsibilities. Married couples may jointly manage the household and the farm, pooling resources, labor, and skills. This economic collaboration can be advantageous for running a farm efficiently. The household distribution of the respondents in Table 1 revealed that majority (33.7%) of the respondents had between 4-6 persons living in their household, 27.9% had a household size of more than 9 persons. Also, 23% of them had a household size of 7-9 persons while only 11.3% of the respondents had a household size of 1-3. Meanwhile the average household size of the respondents was 8. This implies that, on average, there are 8 individuals living in each household engaged in farming activities. A larger household size generally suggests a larger available labor force for agricultural activities (Giller *et al.,* 2021). With eight individuals, there may be more hands available to contribute to various tasks on the farm, such as planting, harvesting, and processing activities. Table 1 further reveals the educational qualification of the rice farmers and from the result it was found that most (40%) of them had secondary school education, 37% had primary education, 14% had no formal education while only 9% had post-secondary education. The result shows that most of the farmers had formal education, which implies that the farmers are educated and well-equipped to understand and implement innovative techniques, technologies, and sustainable agricultural methods. Higher education enhances critical thinking and problem-solving skills. Educated farmers are better positioned to make informed decisions regarding crop management, resource allocation, risk mitigation, and overall farm planning (Nwokoye *et al.,* 2019). The age distribution of the farmers showed that majority (34.9%) of them were between the ages of 31 and 40 years, 32.1% of the respondents were within the age of 41-50 years, 19.3% were at most 30 years of age while only 11.2% of the respondents were older than 50 years. The average age of the rice farmers was 39 years, and this implies that majority of the respondents are still within the productive active age and can effectively engage in farming activities. The performance of a farmer is significantly influenced by age. Compared to the conservative old, younger individuals typically adapt to new technologies more quickly and successfully (Nwokoye *et al.,* 2019). Most (54.2%) of the respondents had a farming experience between 1 to 10 years, 30.1% of the respondents had a farming experience ranging from 11 to 20 years, 7.4% of the farmers had 21 to 30 years farming experience while about 4% had at least 31 years of farming experience. The average year of farming experience is 12 and a half years. Farmers with many years of farming experience will likely possess the ability to make sound decisions as regards resource allocation. Farming experience holds significant importance for farmers across various aspects of agricultural practices, decision-making, and overall sustainability. Farming experience allows farmers to develop practical skills related to crop cultivation, irrigation, pest control, and other essential aspects of agriculture (Nakano *et al.,* 2018). Through hands-on experience, farmers become adept at executing day-to-day tasks effectively. The study revealed that the farmers had an average of 5 contacts with extension workers within a year. About 74% of them had at least 4 contacts with extension workers while 16.3% had between 1 to 3 contacts with extension

workers. Farmers who had no contact with extension workers made up less than 10% of the farmers. Also, most of (95%) of the farmers were members of cooperatives while only 5% were not members of any cooperative society.

This implies that there is high participation in cooperative society activities among rice farmers in the study area.

Table 1: SOCIO ECONOMIC CHARACTERISTICS OF THE RICE FARMERS (N=299)

Variable	Frequency	Percentage
Gender		
Male	184	61.3
Female	115	38.3
Marital status		
Married	188	62.7
Single	84	28.0
Divorced	6	2.0
Widowed	16	5.3
Household size		
1 – 3	34	11.3
4 – 6	101	33.7
7- 9	69	23.0
> 9	84	27.9
Mean	*8*	
Educational level		
No formal school	42	14.0
Primary school	112	37
Secondary school	112	40
Tertiary school	27	9.0
Age		
= 30	58	19.3
31 -40	105	34.9
41 -50	96	32.1
> 50	34	11.2
Mean	*39*	
Experience		
= 10	163	54.2
11 -20	91	30.1
21 – 30	22	7.4
= 30	12	4
Mean	*12.5*	
Extension Contact		
< 1	29	9.7
1-3	49	16.3
4-6	129	43.1
> 6	93	30.9
Mean	*5*	
Membership of Cooperatives		
Yes	285	95.0
No	13	4.3

Source: Field Survey, 2023

B. *Major Causes of Post-Harvest Losses Among the Home-Grown Rice Farmers in the Study Area*

The result in Table 2 shows the major causes of post-harvest losses among home-grown rice farmers in the study area. The study revealed that the major cause of post-harvest losses among the farmers is pest infestation as indicated by 96.7% of the farmers. A pest infestation can lead to reduced grain quality, loss in quantity, increased costs, and may lead to marketability issues since damaged grains could be rejected by buyers and purchased at very low prices (Sharma *et al.,* 2017). Also, 90% of the farmers revealed that delayed harvesting and incomplete threshing were other major causes of post-harvest losses in the study area. Delayed harvesting can lead to over-ripening which can cause low grain quality, reduced milling quality, increased chalkiness, and decreased head rice recovery (Saba and Ibrahim, 2018). In the same vein, incomplete threshing leaves more grains attached to the straw or husks which can lead to lower quality of rice due to the increased levels of impurities, broken grains, and lower milling recovery. Other major causes of post-harvest losses are dependency on traditional threshing methods (89.7%), bird attack on harvested rice (88.7%), lack of technical knowledge on how to minimize post-harvest losses (88.7%), improper handing operation during postharvest activities (88%) and poor conditions of machines (88%).

Table 2: MAJOR CAUSES OF POST-HARVEST LOSSES AMONG THE HOME-GROWN RICE FARMERS IN THE STUDY AREA

Variable	Frequency	Percentage
Pest infestation	290	96.7
Bird attacks on harvested rice	266	88.7
Delayed harvesting	270	90.0
Over or under boiling of paddy during parboiling	250	83.3
Dependency on traditional threshing methods	269	89.7
Improper handling operations during postharvest activities	264	88.0
Inadequate funding to engage in modern processing practices	254	84.7
No mechanical drying activities	260	86.7
Lack of technical knowledge	266	88.7
Incomplete threshing	270	90.0
Improper drying operations	257	85.7
Poor condition of machines	264	88.0
Poor packaging of rice grain	263	87.7
Poor condition of road for transportation	254	84.7

Source: Field Survey, 2023   Note: Multiple responses were allowed

C. *Relationship between Socio-Economic Characteristics and Post-Harvest Handling Practices adopted by Rice Farmers*

Table 3 shows the Chi Square result of the relationship between socio-economic characteristics of rice farmers and their adoption of post-harvest handling practices. The result shows that marital status, farming experience, level of education and membership of cooperative societies had significant relationships with farmers' adoption of post-harvest handling practices in the study area. Marital status had a Pearson Chi-Square value of 44.940 and was significant at 5% level of probability. This implies that marital status significantly influences the adoption of post-harvest handling practices (Ajibesin *et al.,* 2019). Marital status can influence the decision-making process of an individual, their access to resources, and access to labor. These factors can influence their willingness and capacity to adopt some techniques. Married couples, for example, may have more access to labor provided by family members, and this could facilitate the adoption of labor-intensive processing techniques. Farming experience had a Pearson Chi Square value of 388.287 and was significant at 1% probability level. This implies that the number of years of farming by the farmers influences the post-harvest handling practices they adopt. This finding agrees with the assertions that farming experience influences adoption of innovations by farmers (Ngowi and Selejio, 2019). Experienced farmers often possess a deeper understanding of agricultural practices and are more likely to have access to information on new processing techniques through their networks, training, or personal research. The study further shows that level of education with Chi Square value of 39.891 was significant at 10% level of probability. This shows that educational level influences the post-harvest handling technique adopted by the farmers. Farmers with high levels of education might possess better understanding of advanced processing methods and the willpower to implement them, which inadvertently leads to improved efficiency in their post-harvest handling of rice. Also, membership of cooperatives with a Pearson Chi Square value of 30.555 was significant at 1%. This implies that there is a strong relationship between membership of cooperatives and adoption of post-harvest handling practices by rice farmers. In their study on the impact of membership in agricultural cooperatives on yield of smallholder tomato farmers in Nigeria (Akinola *et al.,* 2023), there is a strong relationship between member of cooperatives and adoption of innovations by smallholder farmers. Membership of cooperatives could influence adoption among farmers through access to information and training, access to information and technology, market access, among others.

Table 3: RELATIONSHIP BETWEEN SOCIO-ECONOMIC CHARACTERISTICS AND POST-HARVEST HANDLING PRACTICES ADOPTED BY RICE FARMERS

Variables	Pearson Chi square Value	P-Value
Gender	7.919[a]	.542
Marital status	44.940[a]	.016**
Household size	208.351[a]	.633
Age	431.662[a]	.105
Farming experience	388.287[a]	.008*
Level of education	39.891[a]	0.052***
Extension contacts	171.563[a]	.145
Membership of cooperatives	30.555[a]	.000*

Source: Field Survey, 2023

D. *Constraints to Post-Harvest Handling Practices in Rice Production in the Study Area*
The constraints to post-harvest handling practices among farmers in the study area was assessed and the findings showed that the effect of climate change (this refers to long-term shifts in temperatures and weather patterns) is the biggest constraints or challenge they faced while engaging in rice post-harvest activities. This was indicated by 94.3% of the respondents. Also, 89.7% of the farmers face the challenge of accessing chemicals for storage which is fueled by unavailability, and where available, the cost of purchasing them are exorbitant. Also, 88.7% of the respondents lacked inadequate capital to purchase good storage facilities, and this limits their ability to engage in proper processing of their harvested rice. This is in line with the findings that lack of awareness of good post-harvest practices and technology, inadequate machinery, and lack of incentives to store rice were some of the major constraints to post-harvest handling of rice by farmers (Adeola, 2020). Other challenges bedeviling the proper post-harvest handling of rice among farmers in the study area include poor pricing of rice products in the market (88.3%), poor access road to farms (87.7%), cost of equipment for processing harvested rice (86.7%) and damage by grazing livestock/conflicts with herdsmen (86.7%).

Table 4: CONSTRAINTS TO POST-HARVEST HANDLING PRACTICES IN RICE PRODUCTION IN THE STUDY AREA

Constraint	Mean	Percentage	Decision
Poor technical support from extension agents	214	71.3	Accepted
Cost of equipment for processing harvested rice	260	86.7	Accepted
Lack of awareness of good post-harvest practices and technology	240	80.0	Accepted
Inadequate capital to purchase good storage facilities	266	88.7	Accepted
Stealing of harvested rice from the farm/theft of rice products	249	83.0	Accepted
Poor access road to the rice farms	263	87.7	Accepted
Poor pricing of rice products in the market	265	88.3	Accepted
Lack of technical knowledge on rice processing	253	84.3	Accepted
Damage by grazing livestock/conflicts with herdsmen	260	86.7	Accepted
Infestation by pests	252	84.0	Accepted
Lack of/high cost of chemical for storage	269	89.7	Accepted
Effect of climate change	283	94.3	Accepted

Source: Field Survey, 2023

E. *Test of Hypothesis*

H_o: There is no significant relationship between the socio-economic characteristics of the farmers and the post-harvest handling practices adopted by them.

H_A: There is significant relationship between the socio-economic characteristics of the farmers and the post-harvest handling practices adopted by them.

The chi-square result of the relationship between socio-economic characteristics and adoption of rice post-harvest handling practices in the study area in Table 4.4 revealed that farming experience and membership of cooperative society were significant at 1% probability level, marital status was significant at 5% while level of education was significant at 10% probability. The null hypothesis was therefore rejected for those significant variables while the alternative hypothesis was accepted.

CONCLUSION AND RECOMMENDATION

The study on the analysis of post-harvest handling practices among home-grown rice farmers in Abuja, Nigeria, has shed light on the significant challenges and opportunities within the sector. The findings revealed a mix of traditional and modern practices among farmers, with varying levels of adherence to recommended post-harvest handling techniques. One key finding is the prevalence of traditional methods such as sun-drying and manual threshing, which, while cost-effective, often lead to quality deterioration and post-harvest losses. This underscores the need for greater awareness and adoption of modern post-harvest handling technologies and practices among farmers. The study also highlights the role of education and training in improving post-harvest handling practices, indicating the importance of capacity-building initiatives in the sector. Furthermore, the study identified the need for policy interventions to support smallholder farmers in adopting improved post-harvest handling practices. This includes providing access to affordable and appropriate technologies, enhancing market linkages, and promoting the use of quality standards. Overall, the findings of this study have implications for policy, practice, and research in the agricultural sector. By addressing the challenges identified and promoting best practices, stakeholders can work towards reducing post-harvest losses, improving food security, and enhancing the livelihoods of rice farmers in Abuja (F.C.T).

Based on the findings of the study, the following recommendations are suggested to improve post-harvest handling practices among home-grown rice farmers in Abuja (F.C.T), Nigeria:

a. Government through relevant agencies should implement training programs and workshops to educate farmers on best practices in post-harvest handling, including proper drying, storage, and transportation techniques, as well as proper record keeping.

b. Also, government and international donor agencies should provide farmers with access to affordable and appropriate storage facilities, such as silos and warehouses, to reduce post-harvest losses.

c. Farmers' access to markets should be improved by establishing market linkages and improving transportation infrastructure to enable them to sell their produce more efficiently.

d. The government should provide support in the form of subsidies, grants, or loans to help farmers acquire the necessary equipment, infrastructure for post-harvest handling

e. And all rice farmers are encouraged to join co-operative society for joint effort in tackling some of their challenges.

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