FUDMA Journal of Sciences (FJS)
ISSN: 2616-1370
Vol. 2 No. 1, April, 2018, pp 17-22

POST HARVEST LOSS IN RICE PRODUCTION: EVIDENCE FROM A RURAL COMMUNITY IN NORTHERN NIGERIA

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ABSTRACT
Rice is a major food crop in Nigeria but the supply of the crop is constrained by several factors such as Post harvest loss (PHL). PHL constitutes a threat to household food and nutrition security as it leads to reduction in both quality and quantity of household food production. This study was conducted to increase our understanding of the menace with a view to proffering lasting solutions. Using primary data collected from a village survey of 100 Rice farmers in Niger State, we determined the stages, causes, quantity and value of PHL in rice. We found that the major stages of PHL were at harvesting and postharvest handling, point of processing, at storage, and during transportation to place of storage or marketing. PHL was higher with paddy rice and occurred mostly during harvesting while the losses for milled rice occurred mostly during storage. The causes at various stages were due to spillage, breakage due to over drying, rodent attack, theft, and spillage due to poor packaging materials used during transportation. Based on findings from the study, we conclude that Postharvest loss especially in paddy rice, has proved to be a threat to rice production and household food security. We recommend that the state agricultural extension service should enlighten farmers on proper postharvest handling methods for rice. The provision of modern processing and storage facilities such as rice destoners, metal silos and Purdue Improved Crop Storage by government and NGOs at subsidised rates can help to reduce PHL in rice.

Keywords: *Post harvest Loss, Rice, Food security, Nigeria*

INTRODUCTION

Rice is the most cultivated crop in the world. It is a major constituent of the diets consumed in many developing countries, and also a stable food in many countries in Africa. In 2006, paddy rice production in sub-Saharan Africa was estimated at 14.2 million tonnes and rice production in this zone grew at 3.23% per annum from 1961 to 2005 (African Rice Centre, 2007). In 2011, paddy rice production in Sub Saharan Africa (SSA) was estimated at 14.2 million tons. Rice production in SSA grew at 3.23% per annum from 1961 to 2005. This growth rate was higher than the yearly population growth rate of 2.90% during the same period (Onu et al., 2015). Rice constitutes over 20% of total food expenditure among urban and rural households. The demand for rice has grown significantly over the last 40 years due to changing consumer dietary patterns and population growth. In 2014, the annual rice demand in Nigeria was estimated at 5.9 million MT. However, only an estimated 2.7 million MT of milled rice was produced locally, leading to a demand supply deficit that was filled by imports (Sahel, 2015). Rice is commonly consumed as a food crop for household security. The average Nigerian consumes 24.8 kg of rice per year, representing 9 per cent of annual calorie intake (IRRI, 2001 as cited by Bamidele et al., 2010). Due to the large population of Nigeria, it is the region's largest consumer of rice in absolute terms. The country's estimated annual demand for milled rice is 5.2 million tons, while the average national production is 3.3 million tones. The supply and demand gap of 1.9 million tones can only be bridged by importing rice. Nigeria's rice processing capacity is 2.8 million tones of paddy (GIZ, 2014). In spite of these developments, the country is unable to reach the self-sufficiency in local production and this is partly caused by huge post-harvest losses (PHL). PHL refers to measurable quantitative and qualitative food loss in the postharvest system (De Lucia and Assennato, 1994 as cited by Kiaya, 2014). Post-harvest losses occurs between harvest and the moment of human consumption and includes on-farm losses, such as when grain is threshed, winnowed and dried, as well as losses along the chain during transportation, storage and processing (Wikipedia, 2016).

The provision of adequate, nutritious and affordable food for all is the fundamental basis for food security. Although there is remarkable progress made in increasing food production worldwide, approximately half of the populations in developing countries do not have access to adequate food supply; thus the food security problem is worsening. There are many reasons for this, one of which is food losses occurring throughout the supply chain from production, harvesting, processing and marketing (Chukwuta, 2014). In its report on "Global food losses and food waste" the FAO (2011), stated that roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year. Ukoh-Aviomoh et al, (2005) as cited by Coker and Ninalowo (2015) also reported that these losses lead to heavy loss of income and food supply to rural families, thereby threatening household food security and that, in the face of threat of household food security, malnutrition easily results. FAO has documented that rice post-harvest losses are among the highest of the major crops grown in developing countries and has called attention to the potential to be gained by reducing postharvest losses of rice. Rice is subjected to more handling and processing steps as it moves from the rice paddy or field to the consumer than other grain products in developing countries. Little mechanization exists in rice processing, and where it does, it is most often antiquated or makes use of poorly designed equipment. The lack of adequate processing equipment contributes significantly to postharvest losses in rice, which have been estimated to be as high as 40% of total production (Saunders et al., 1980). This current study is thus timely as it characterized the incidence of PHL in rice production. Specifically, the study identified the stages, causes, quantity and value in monetary terms of post harvest losses in rice. It is expected that the findings will help to shape policies that will help the study area and indeed country to be self sufficient in rice production.

METHODOLOGY

The study was conducted in Katcha Local Government Area of Niger State, a rural community notable for rice production. It has a population of about 122,176 and land area of 1,681 km^2 NPC, 2006). Farming is the major activity in the community. The major crops grown in the area are rice, maize, wheat, sorghum, tomatoes, pepper, spinach and onions. Major livestock are poultry and small ruminants such as sheep and goat. The major ethnic group is Nupe, others include Kakanda, Hausa and Gbagyi. In selecting the respondents, a village listing survey was conducted to identify the major rice producing villages in the study area. A multi-stage sampling technique was then utilized to select 100 respondents for the study. The first stage involved a purposive selection of 8 villages from the list of rice producing villages. The second stage involved the selection of rice farmers' cooperative societies from each of the selected villages. The last stage involved the random selection of rice farmers from the cooperative society using the technique of proportionate sampling. The expression below was used for the process while the sampling frame and sample size are presented in Table 1.

$n = x/X*N$

where;

n = Number of respondents selected/village

x = Number of registered farmers in a Village

X = Total Number of farmers in the selected Villages

N = Sample size (100)

Table 1: Sampling Frame and sample size

Village	Number of Registered Farmers	Number of Farmers sampled
Managi	22	13.0
Enu-woro	26	15.0
Ninibo	20	11.0
Bologi	35	20.0
Kyadya	21	12.0
Tabo	16	9.0
Tako	35	20.0
Total	175	100.0

Primary data was used for the study. This was collected with the aid of structured questionnaire that was administered to the sampled respondents by trained enumerators. Data collection lasted for a period of three weeks. Simple descriptive statistics such as frequency counts, percentages and mean were used to describe the stages and causes of PHL while direct valuation of quantity of PHL in rice using current market price was used to quantify the post-harvest loss in rice.

RESULTS AND DISCUSSION

Forms of occurrence of PHL in Rice production

The forms in which PHL occurs in rice production in the study area are shown in the Table 2. The results revealed that majority of the respondents suffered PHL when rice was still in the paddy form. However, some of the respondents reported that they experienced PHL in rice at the milled rice form. This implies that efforts to reduce PHL must focus on milled and paddy forms of rice.

Table 2: Forms of occurrence of PHL in Rice Production

Form of Rice	Frequency	Percentage (%)
Paddy only	52	52.0
Milled only	24	24.0
Both	24	24.0
Total	100	100

Source: Field survey, 2017.

Stages of occurrence of PHL for Rice at Paddy and Milled forms

The findings of the study as shown in Table 3 revealed that most of the respondents experienced PHL in paddy rice during harvesting. The result aligns with the findings of Guisse (2010), who reported that farmers experience post harvest losses at the harvesting stage due to numerous reasons. Losses during transportation from the farm to the place of storage or milling are also on the high side.. The result in Table 4 also revealed that most rice farmers experienced PHL on milled rice during storage, followed by losses during transportation.

Table 3: Stages of occurrence of PHL in paddy Rice

Stages	Frequency	Percentage (%) n=76
Harvesting	73	96.1
Processing	27	35.5
Storage	48	63.2
Transportation	59	77.6
Marketing	12	15.8
Post harvest handling	34	44.7
Total	**253***	

*Source: Field survey, 2017. *Multiple responses were allowed*

Table 4: Stages of occurrence of PHL in milled Rice

Stage	Frequency	Percentage (%) n=48
Storage	43	89.6
Transportation	36	75.0
Marketing	8	16.7
Total	**87***	

*Source: Field survey, 2017. *Multiple responses were allowed*

Cause of PHL at harvesting stages for paddy rice

The results as shown in Table 5 revealed that spillage was the major cause of postharvest losses at harvesting stage and postharvest handling stages respectively. Other losses were induced by breakage during manual threshing operations.

Table 5: Cause of PHL at harvesting stage for paddy rice

Cause	Frequency	Percentage (%)
Spillage	40	52.6
Breakage due to over threshing	11	14.7
No response	42	55.3
Total	**93***	

*Source: Field survey, 2017. *Multiple responses was allowed*

Causes of PHL at processing stage

The findings of the study as shown in Table 6 further revealed that most of the respondents' experienced postharvest losses during processing operations as a result of breakage of rice grains due to over drying, partial cooking of paddy rice due to overheating and breakdown of milling machine during the milling operation.

Table 6: Causes of PHL at processing stage

Causes	Frequency	Percentage (%)
Mechanical damage	4	5.3
Spillage	3	3.9
Partial cooking of paddy due to overheating	17	22.4
Breakage due to over drying	18	23.7
Breakdown of milling machine	13	17.1
Discoloration due to over drying	2	2.6
No response	49	64.5
Total	**106***	

*Source: Field survey (2017). *Multiple responses was allowed*

Causes of PHL at Storage stage

The various causes of PHL at storage stage for both paddy and milled rice are shown in Table 7. The majority of respondents indicated that rodent attack was the major cause of PHL in rice during storage, followed by Insect pest attack. This result aligns with the findings of the study of Chukwuta (2014) who reported that the major factors that cause PHL are lack of storage facilities, lack of processing facilities, lack of transportation facilities and rodent attack.

Table 7: Causes of PHL at storage stage

Causes	Paddy (n=76)		Milled (n=48)	
	Frequency	**Percentage (%)**	**frequency**	**Percentage (%)**
Insect pests attack	33	43.4	17	35.4
Rodent attack	34	44.7	34	70.8
Theft	1	1.3	5	10.4
Fire	2	2.6	0	0.0
Rotting due to moist conditions of store	1	1.3	1	2.1
No response	28	36.8	5	10.4
Total	**99***		**62***	

Source: Field survey, 2017. **Multiple responses was allowed*

Causes of PHL at marketing stage

The findings of the study as shown in Table 8 revealed that theft of rice was the main cause of postharvest loss at marketing stage. This normally occurs at night when the store is burgled and rice taken away by unknown persons.

Table 8: Causes of PHL at marketing stage

Causes	Paddy (n=76)		Milled (n=48)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Theft	12	15.8	5	10.4
Fire	0	0.0	3	6.3
No response	64	84.2	40	83.3
Total	**76**	**100**	**48**	**100**

Source: Field survey (2017)

Causes of PHL at transportation stage

The survey result as shown in Table 9 revealed that PHL at the transportation stage was as a result of spillage due to poor packaging materials used during transportation of paddy and milled rice respectively. The road condition from farm gate to the home or store can also exacerbate losses at this stage.

Table 9: Causes of PHL at transportation stage

Causes	Paddy (n=76)		Milled (n=48)	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**
Theft	1	1.3	1	2.1
Fire	2	2.6	0	0
Spillage due poor transportation devices	24	31.6	16	33.3
Spillage due to poor packaging materials used during transportation	42	55.3	24	50.0
Spillage due to poor road network	40	52.6	24	50.0
No response	17	22.4	12	25.0
Total	**126***		**77***	

*Source: Field survey (2017). *Multiple responses was allowed*

Quantity of PHL at respective stages

Data was collected on the estimated quantity of PHL in rice at different stages along the rice value chain. The results are as presented in Table 10. The majority of the losses occurred during the storage stage (9650.73kg) representing about 56.7% of the total loss experienced in the study area. This was followed by losses during marketing (20.7%). The total PHL in the study area as reported by the sampled respondents was 17034.27kg, which is equivalent to approximately 227.12 bags per annum (using a 75kg sack as used in the study area). This is a very huge loss that must be curbed without delay if household food production and availability is to be enhanced.

Table 10: Estimate of PHL at respective stages as a % of total loss

Stages	PHL in kg	Percentage of total loss (%)
Processing	803.20	4.7
Storage	9650.73	56.7
Transport	2439.79	14.3
Post-handling	615.55	3.6
Marketing	3525.00	20.7
Total	**17034.27**	**100.0**

Source: Field survey, 2017.

Value of PHL at respective stages in monetary terms

The quantity of PHL in rice at the different stages is presented in Table 11. The result revealed that the major PHL occurred at the storage stage followed by marketing stage. This finding implies that there could be a threat to household income generation if the menace is not curbed on time.

Table 11: Quantity of PHL at respective stages in physical and monetary terms

Stages	Quantity (bags)	Quantity (Kg)	Value in Naira/year
Processing	11	803.20	104,500.00
Storage	129	9650.73	1,225,500.00
Transport	33	2439.79	313,500.00
Post-handling	8	615.55	76,000.00
Marketing	47	3525.00	446,500.00
Total	**228**	**17034.27**	**2,166,000.00**

Source: Field survey (2017).

CONCLUSION AND RECOMMENDATIONS

Based on findings of the study, we conclude that Post-harvest loss mostly in paddy rice is a serious threat to rice production and can negatively impact on household food security. Based on the findings of the study, the followings are recommended: Extension agents must enlightened farmers on proper postharvest handling methods for rice. This can be through renewed and continuous sensitization through radio, pamphlets, leaflets, demonstrations on rice post-harvest handling and loss prevention by the Extension arm of the Niger State Ministry of Agriculture. Farmers should be supported through the provision of proper processing and storage facilities such as rice destoners, metal silos and Purdue Improved Crop Storage (PICS), by relevant Government agencies. The Niger Sate Agricultural Development Project, NAMDA and NCRI should work hand in hand to develop and provide farmers with efficient and affordable rice milling machines in order to improve the quality of milled rice.

REFERENCES

Africa Rice Center (WARDA), (2007). 'Africa Rice Trends: Overview of recent developments in the sub-Sahara, Africa rice sector. *Africa Rice Center Brief*.: Africa Rice Center (WARDA) Cotonou, Benin 10p.

Bamidele FS, Abayomi OO and Esther OA (2010). Economic Analysis of Rice Consumption Patterns in Nigeria: *Journal of Agricultural Science and technology* 12:1-11

Bolarin FM and Bosa SO (2015). Post Harvest Losses: A Dilemma in Ensuring Food Security in Nigeria. *Journal of Natural Sciences Research* 5(4): 151-154

Chukwunta C (2014). *An Analysis of post harvest losses Management Strategies by Farmers in Awgu local government Area of Enugu Stat Nigeria*. Unpublished Master of Science thesis submitted to the Institute for Development Studies, University of Nigeria, Nsukka.

Coker AA and Ninalowo SO (2015). Effect of Postharvest losses on rice farmers' income in Subsaharan Africa: a case of Niger state, Nigeria; *Journal of Agricultural Science and Food Technology*. 2 (3): 27-34

FAO (2011). Global food losses and food waste-Extent, causes and prevention. Rome

GIZ (2014). Post-Harvest Losses of Rice in Nigeria and their Ecological Footprint: Federal Ministry for Economic Cooperation and Development

Guise R (2010). Post harvest losses of rice (oriza spp) from harvesting to milling: a case study in Besease and Nobewam in the Ejisu Juabeng district in the Ashanti region of Ghana. An unpublished Master's degree thesis submitted to Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

IRRI (2009). Rice Policy- World Rice Statistics (WRS).http://www.irri.org/science/ricestat, accessed 28th March 2017.

Kiaya V (2014). Post harvest losses and strategies to reduce them: A Technical paper submitted to Action Contre la Faim (ACF) 25p.

Onu DO, Obike KC, Ebe FE and Okpara BO (2015). Empirical assessment of the trend inrice production and imports in Nigeria (1980 – 2013): *Journal of Agricultural Science and Soil Science. 5(6): 150-158*

Oteng JW and Sant'Anna R (2015). Rice production in Africa: current situation and issues, published by Senior Research

Scientist, Faculty of Agriculture, University of Ghana, Accra; Soil Resources Officer, FAO Africa Regional Office, Accra

Sahel (2015). Rice in Nigeria: Industry Dynamics, A bulletin of Sahel Capital, Volume 12

Saunders RM, Mossman AP, Wasserman T, and Beagle EC (1980). Rice Postharvest Losses in Developing Countries*, USDA Agricultural Reviews and Manuals*, ARM-W-12, USDA , Oakland, CA USA.

Wikipedia (2017) https://en.m.wikipedia.org (Accessed 28th March).