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Postharvest Grain Storage Techniques Utilized by Traders in Ilorin West Local Government Area, Kwara State, Nigeria

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Abstract

Post-harvest grain losses is a major constraints inhibiting sustainable food availability and accessibility in Nigeria and the use of proper long-term storage techniques remain a major issue of discuss globally. This study therefore examines the post-harvest grain storage techniques utilized among marketers using Ilorin West LGA in Kwara State Nigeria as a case study. A structured questionnaire was used to elicit information from 120 traders who were selected through a two-staged sampling procedure. Descriptive statistics and PPMC model were used in analysing the data. The result revealed that maize and millet were the prominent grains stored by the traders. The storage techniques utilized by majority of the traders were traditional methods and use of chemicals while only few of them made use of innovative storage techniques such as PIC sacks and hematic bags. Educational status, years of storage experience and average income were significant correlates of the choice of storage technique utilized by the traders. The study recommended more extension engagement with grain traders in order to increase the utilization of modern storage techniques and the provision of subsidy for them by government to encourage more utilization of these techniques.

Keywords: *Postharvest, Grain storage, Techniques, Utilization, Traders*

Introduction

Globally, over 33% of food is lost or wasted during postharvest handling and this is a major barrier to sustainable food security (Kumar and Kalita, 2017) and postharvest food losses is one of the important sources of food insecurity in Africa (Okoruwa *et. al*, 2009). Grain cereals serve as the basic food for a lot of households and have become the foundation of World food security (Olorunfemi *et al*., 2014). In Nigeria, grain cereals are the most important food crop cultivated and consumed by more than 70% of the population (IITA, 2004).

Grain have been said to account for the highest level of postharvest losses on calorific basis among all agricultural commodities and a greater percentage of these losses takes place during storage (Kumar and Kalita, 2017; FAO, 2014; Gustavsson *et al*., 2011). The utilization of proper strategies to reduce grain losses therefore will be a major way in ensuring food security and improving the livelihoods of farmers, traders and consumers.

The main objectives of grain storage are to maintain quality and availability all the year round. Long term grain storage is profitable (Beranek, 2010) and one of the major factors in determination of grain sales is storage structures. Utilization of storage facilities is anticipated to increase marketing flexibility thereby strengthening marketing position. Importance of storage structure in grain marketing is highlighted by Oelke *et al.* (2008), who stated that when much grain is damaged during storage it result in reduced profits. Good storage management is essential to prevent spoilage

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which is caused by mould growth and insect activity. A properly managed aeration system greatly improves the storability of grains by maintaining a cool, uniform temperature throughout the storage to reduce mould growth, insect activity and prevent moisture migration. Although the traders have their old way of storing grains a lot of them are still battling with the problem of pest infestation and grain losses. A lot of storage techniques have been developed to reduce postharvest losses and the use of these techniques is expected to lead to reduction in grain losses, increase grain availability and improved income to the traders. Therefore, there is the need to examine the various storage techniques utilized especially among traders who are in the middle of the value chain so as to ensure informed strategies are embarked upon as revealed that will ensure a more sustainable availability and accessibility of grain products to the final consumers. To this end, specifically, the study aimed at ascertaining the socioeconomic characteristics of the grain traders, identifying the sources of information available to the grain trader on grain storage, evaluating the storage techniques used by the grain traders and enumerating the constraints faced by grain traders in effective storage of grains in the study area.

Methodology

Study Area: The study was conducted in Ilorin West Local Government Area of Kwara State, Nigeria. The Local Government Area is located between 8^0.30'North and longitude 4^0 35'North of the equator covering 54.2 square kilometres. Ilorin West is one of the sixteen Local Government Areas of Kwara State with its Headquarter in Warah and a total population of 364, 6669 (NPC, 2006). It is regarded as the most populated Local Government Area in the State. It has four districts (Ajikobi, Alanamu, Magaji ngeri and Warah/Osin/Egbejila). The annual rainfall is 130mm and the wet season is between March-October and the dry season is between November-February. The major tribes are Yoruba, Hausa and Fulani while the major occupations are farming, agricultural commodity trading and cloth weaving. The Local Government shares boundary with Ilorin east, Asa and Ilorin south Local Government Areas. The major grain markets are; Oja ago, Mandate market and Ita-ama market.

The population of the study comprises of all grain traders in Ilorin West Local Government Area of Kwara State. Two - stage sampling techniques was used for this study. The first stage involved the purposive selection of three major markets, the major grain markets are; Oja ago, Mandate market and Ita-ama. The markets were purposively selected because they are known for having the highest number of grain traders. The second stage involved the random selection of 40 respondents using the register of grain traders' association (with actual population of 320 members) from each of the three selected grain markets given a sample size of 120 respondents. Data was collected from the respondents over a period one month. The collected data was analyzed using descriptive statistics such as percentages, means and ranks, while Pearson Product Moment Correlation was used to analyze the relationship between the socio-economic characteristics (sex, age, marital status, household size, experience, average monthly income) of the respondents and the storage technique utilized by them.

The coefficient of correlation was calculated using the formula:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

Where,

X was the socio-economic characteristics of the respondents which were

X_1 = Sex,

X_2 = age,

X_3 = marital status,

X_4 = household Size,

X_5 = educational Status,

X_6 = years of storage and

X_7 = monthly income;

Y was the types of storage techniques utilized. This was computed by using the count outcomes of the number of storage techniques used to generate a score for each respondents which was then correlated with their socio-economic characteristics; n was the number of observations of these variables.

Results and Discussion

Table 1 showed that the average age of the respondents in the study area was 38 years, which implies that the respondents were in their productive and active age to undertake cumbersome task associated grain aggregation and storage. The table also showed that majority (75.0%) of the respondents were male, 70% of them were married, 21.7% were single, 5.0% were separated, and 2.5% were divorced while the rest 0.8% were widowed. The fact that majority of the respondents were married could make them to engage more in grain aggregation and storage to enhance their income for family upkeep, Less than half (41.7%) of the respondents have no formal education while only 15.0% had tertiary education. The low literacy level in the study area could make adoption of innovation in grain aggregation and storage a huge challenge. The average years of experience in grain storage is 8 years while the mean income of a typical respondent in the study area was #14,000. The average household size is 6 persons. This is in consonance with the average persons per rural household as established by the National Bureau of Statistics (NBS) (2006) further confirming that respondents have dependent and are with great family responsibilities and this is expected to contribute to grain aggregation and storage.

Table 2 presents multiple responses of the respondents on the sources utilized on grain storage information in the study area. It was revealed that majority of the (76.7%) respondents indicated family, friends and neighbours as their major source of information, a little below average (47.5%) of them stated they utilize radio as their source of information on grain storage while only very few (6.7%) accessed information on storage techniques form extension agents. This finding agreed with Ajuwon and Odeku (2012) and Mugwisi and Mostert (2012) who identified that the most effective way of disseminating agricultural information is face to face communication which family, friends and neighbours provide. The low ratio of extension agents to farmers in Nigeria could possibly account for low patronage of extension agents for information by the respondents in the study area.

Table 1 Socio-economic characteristics of the respondents (n=120)

Variable	Frequency	Percentage (%)	Mean score
Age (years)			
21-30	32	26.6	38
31-40	51	42.5	
41-50	18	15.0	
51-60	14	11.7	
61-70	5	4.2	
Sex			
Male	75	62.5	
Female	45	37.5	
Marital status			
Single	26	21.7	
Married	84	70.0	
Divorced	3	2.5	
Widow/widower	1	0.8	
Separated	6	5.0	
Level of Education			
No formal education	50	41.7	
Primary education	21	17.5	
Adult/Quaranic education	10	8.3	
Secondary education	21	17.5	
Tertiary education	18	15.0	
Experience (years)			
≤10	101	84.2	8
11-20	12	10.0	
21-30	6	5.0	
31 & above	1	0.8	
Religion			
Islam	61	50.8	
Christianity	59	49.2	
Monthly income (Naira)			
≤ 10,000	30	25.0	14,000
11,000 – 20,000	74	61.7	
21,000 – 30,000	16	13.3	
Household size (number of persons)			
1-5	61	50.8	6
6-10	51	42.5	
11-15	8	6.7	
Total	120	100	

Source: Field Survey (2018)

Table 2 Respondents distribution according to the Sources of information utilized

Sources	Frequency	Percentage (%)
Family, Friends & Neighbors	92	76.7
Community leaders	47	39.2
Radio	57	47.5
Television	20	16.7
Print media	11	9.2
Extension agents	8	6.7
Workshop / Seminar	6	5.0
Social media	35	29.2
Group / Association	6	5.0
Cooperative society	16	13.3
Research institutes	11	9.2

Source: Field Survey 2018. *Multiple responses.

Result from Table 3 revealed that majority (88.3%) of the respondents engage in maize storage, 36.7% of them stored Millet, cowpea storage accounted for 20.0% while sorghum storage had 7.5% respondents. The fact that maize was widely stored by the respondents confirms the predominance of maize cultivation by the farmers in the study area occasioned by the multiple usages of maize for both human and livestock consumption. This finding is in line with Fakayode (2001) who stated that maize has always been preferred to any other crop including cassava by most households in the area.

Table 3 Distribution of respondent based on the type of grain stored

Crop	Frequency	Percentage (%)
Maize	106	88.3
Cowpea	24	20.0
Millet	44	36.7
Sorghum	9	7.5

Source: Field Survey 2018. *Multiple responses.

Table 4 shows the distribution of the respondents according to the different types of grain storage methods used in the study area. According to the table, 72.5% of the respondents use traditional method for grain storage, 50.8% use chemicals, 30.0% use PICS sacks, 10.8% use botanicals and steel drum, 9.2% use Rhombus and Plastic & Gourds, 8.3% use Earthen pot ware while Cribs and Zero fly hermetic bags accounted for 6.7% and 4.2% of the respondents respectively. It is alarming to note that more than half (50.8%) of the respondents use chemicals to store grains in the study area. The implication of this is that there is the risk of chemicals not been appropriately applied considering the low level of education of the respondents and their relatively average years of storage experience. This could have a far reaching effect on the unsuspecting end users of the grains while the respondents are also exposed to possible health hazard. As stated by Okoruwa *et al.* (2009), food grains storage using chemicals are sometimes toxic and usually have residual effects which overtime leads to environmental pollution and health hazards.

Table 4 Distribution of respondents based on the types of storage methods Utilized

Storage facilities	Frequency	Percentage (%)
Traditional method	87	72.5
PICS Sacks	36	30.0
Zero fly hermetic bags	5	4.2
Use of botanicals	13	10.8
Use of chemicals	61	50.8
Rhombus	11	9.2
Plastic & Gourds	11	9.2
Earthen pot ware	10	8.3
Steel drum	13	10.8
Cribs	8	6.7

Source: Field survey 2018. *Multiple responses.

Table 5 presents the opinions of the respondents on the frequency of use of storage methods and this was presented on a 4-point scale of always (4), sometimes (3), rarely (2) and never (1). The result revealed that traditional method of grain storage ranked 1St and it is considered the most frequently used method among the traders. Grain storage using chemicals ranked 2nd in terms of frequency of use, PICS sacks was ranked 3rd by the respondents while Cribs was ranked 10th as the least method of storage used by the respondents. There is a correlation between the responses of the grain traders on types of storage methods used (Table 4) and frequency of use of storage methods (Table 5). The two tables confirm the prominence of use of chemicals in the storage of grains among the respondents. However, as opined by Kumar and Kalita (2017), despite the potential effectiveness that the utilization of chemicals seems to have, it still has a lot of limitations beginning with the need to be well knowledgeable on right application, issues of pest resistance and re-infestation, environmental contamination and health hazards.

Table 5 Frequency of Storage techniques utilized by the grain traders

Storage facilities	Always (%)	Sometimes (%)	Rarely (%)	Never (%)	Mean score	Rank
Traditional method	42 (35)	36 (30)	0 (0.0)	30 (25)	2.55	1st
PICS Sacks	24 (20)	21 (17.5)	2 (1.7)	56 (46.7)	1.83	3rd
Zero fly hermetic bags	2 (1.7)	4 (3.3)	0 (0.0)	114 (95.0)	1.58	4th
Use of botanicals	9 (7.5)	6 (5)	6 (5.0)	105 (87.5)	1.43	5th
Use of chemicals	41 (34.2)	12 (10)	1 (0.8)	83 (69.2)	2.37	2nd
Rhombus	5 (4.2)	7 (5.8)	0 (0.0)	108 (90.0)	1.24	7th
Plastic & Gourds	6 (5)	5 (4.2)	0 (0.0)	109 (90.8)	1.23	8th
Earthen pot ware	7 (5.8)	2 (1.7)	0 (0.0)	111 (92.5)	1.21	9th
Steel drum	9 (7.5)	3 (2.5)	1 (0.8)	107 (89.2)	1.28	6th
Cribs	1 (0.8)	3 (2.5)	0 (0.0)	116 (96.7)	1.10	10th

Mean Score derived from always=4, sometimes=3, rarely=2, never=1
Source: Field survey 2018.

Table 6 presents the severity of factors militating against the use of storage facilities in the study area, many of the respondents believed that some storage facilities are too expensive to acquire and the respondents ranked it 1st, high cost of maintenance of storage technique was ranked 2nd while hazard posed to human life by certain storage technique ranked 3rd. Non reliability of certain storage technique was however ranked 9th by the respondents in the study area. This implies that the issue of cost is a key factor influencing the choice of grain storage technique among the traders. This could have probably informed the grain traders' choice of local/traditional techniques rather than the use of modern storage techniques which they considered to be more expensive. This is because traders often store grains for limited period of time so that they could make immediate profit and hardly provide for domestic consumption (Kimenju, *et al.*, 2009)).

Table 6 Constraints militating against the effective use of modern storage facilities

Storage facilities	**Very severe (%)**	**Severe (%)**	**Fairly severe (%)**	**Not severe (%)**	**Mean score**	**Rank**
Expensive	34 (28.3)	49 (40.8)	35 (29.2)	2 (1.7)	1.96	1st
Cost of maintenance	42 (35)	31 (25.8)	38 (31.7)	9 (7.5)	1.89	2nd
Hazardous to life	37 (30.8)	28 (23.3)	36 (30)	19 (1.6)	1.70	3rd
Inadequate knowledge	27 (22.5)	23 (19.2)	23 (19.2)	47 (39.2)	1.25	4th
Environmental condition	13 (10.8)	10 (8.3)	39 (32.5)	58 (48.3)	0.83	7th
Not available	13 (10.8)	14 (11.6)	38 (31.7)	55 (45.8)	0.88	5th
Not durable	10 (8.3)	13 (10.8)	44 (36.7)	53 (44.2)	0.84	6th
Not effective	10 (8.3)	13 (10.8)	42 (35)	55 (45.8)	0.82	8th
Not reliable	7 (5.8)	7 (5.8)	45 (37.5)	61 (50.8)	0.68	9th

NB: Very severe = 3; severe = 2; fairly severe = 1; not severe = 0. Source: Field survey 2018.

Socio-economic correlates of the types of storage technique utilized

Findings from Table 7 showed the correlation coefficients of the relationship between selected socio-economic characteristics of the respondents and the types of the storage facilities used. The result shows that the level of education ($r = 0.152$, $p<0.050$), storage experience ($r = 0.950$, $p<0.050$) and monthly income ($r =0.100$. $p<0.050$) have positive correlation with the types of storage techniques used. However, there was no correlation between the respondents' age ($r =-0.339$, $p>0.050$) sex ($r= -0.390$ $p>0.050$), marital status ($r = 0.420$, $p>0.050$), household size ($r = -1.680$, $p>0.050$) and the type of storage techniques used by them. This shows that the level of

education, storage experience as well as respondents' monthly income are somewhat related to the type of storage facilities utilized. This implies that an increase in the educational level of the respondents, their years of storage experience and their monthly income usually result in an increase in the number and diversity of storage technique utilized by the grain traders. This is in line with Okoruwa *et al.* (2009) who stated that the educational level of farmers and cost of techniques influence the type of storage techniques utilized.

Table 7 Pearson product moment correlation between the socio-economic characteristics of the respondent and the types of storage techniques used

Variable	**r value**	**p value**	**Significant status**
Sex (x_1)	-0.390	0.674	Not significant
Age (x_2)	0.080	0.338	Not significant
Marital status (x_3)	0.420	0.651	Not significant
Household size($x_{4)}$	-1.680	0.606	Not significant
Educational status (x_5)	0.152	0.010	Significant
Storage experience (x_6)	0.950	0.039	Significant
Monthly income(x_8)	0.100	0.046	Significant

Significant at p 0.05 Source: Field survey 2018.

Conclusion and Recommendation

The study concluded that majority of the traders engage in the storage of their grains using traditional method while the low use of crib PICS sack, Zero-fly hermetic bags and botanicals could be ascribed to the high cost associated with the utilization of these storage techniques. Also, aside the traditional methods of storage, the use of chemicals was also very prominent in the study area when compared with other modern techniques. Significant correlates of the type and diversity of storage techniques utilized by the traders include their educational status, years of storage experience and their average income. Considering the relatively low level of education of the respondents, the study recommended the need to intensify more effort in educating and training the grain traders on the correct timing, dosage, proper application and handling of these chemicals so as to reduce drastically the potential hazard of grain contamination and health challenges that can result from improper use of these chemicals. Also, as pointed out in the constraints, since the issue of cost was a major factor determining the type of storage techniques utilized, governments should assist the traders with the subsidization of some of these techniques and provision of credit facilities as appropriate to increase the utilization of modern techniques that are more effective and less hazardous in the study area.

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