Assessment of Maize Storage Techniques Utilized by Small-Scale Farmers in Anambra State, Nigeria

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Abstract

The study accessed maize storage techniques utilized by small-scale farmers in Anambra State, Nigeria, due to lack of modern and appropriate storage technologies for grains. The specific objectives includes; socio-economic characteristics; methods of storage techniques; reasons for storing; effects of socio-economic factors on maize revenue; and challenges faced by the respondents. Multi- stage sampling techniques were employed to select sample size of 120 respondents. Primary data were collected through the use of questionnaire and interview schedule. Data obtained were analyzed with descriptive and inferential statistics. The results revealed that 65.8% were female, 67.5% married, 80.0% were literate, and annual income of ₦511.13. 80.0% stored maize in cribs and identified household consumption and increased income as their major reasons for storing maize. The regression analysis indicated a significant and positive relationship between total revenue and storage cost at 1% and 5% probability levels. The factors that constrained the respondents includes; pests and insects (m=2.92); lack of modern method and management (m=2.83); and lack of extension agents (m=2.75) The study suggests that the maize storage farmers should be encouraged to reduce pests and diseases, trained and motivated to use modern storage facilities. Finally, extension agents should sit-up to its responsibilities in the dissemination of useful information to maize farmers.

Key words: *Assessment, Maize, Storage, Techniques, Farmers, Anambra, Nigeria*

Introduction

Before agriculture became widespread, people spent most of their lives searching for food, hunting wild animals and gathering wild plants. About 11,500 years ago, people gradually learned how to grow cereal and root crops, and settled down to a life based on farming. Agricultural products provides food on the table of human, thereby increasing their standard way of living (Oladejo, 2016). All agricultural products either plant or animal origin starts deteriorating almost as soon as they are harvested from farm and these leads to losses of their nutritional contents. The deterioration of an agricultural product may be harmful to human health and bring changes to the farmers. Maize as one of the agricultural products, is an important food for man and an ingredient of poultry and livestock feeds. It often with high moisture content during harvest and it is liable to microbial deterioration even during storage (Bezu, Kassie, Shieferaw and Ricker-Gilbert, 2014). This sort of loss is unfortunate because it both lowers the income and standard of living of the farmers and also leads to waste of a large fraction of what is supposed to be a contribution to the nation's food supply.

Maize (*Zea mays*), known in many English-speaking countries as corn, is a grain domesticated by indigenous peoples of Mesomaria in prehistoric times. It is the third most important cereal grain worldwide after wheat and rice (Ajani and Onwubuya, 2012). It is referred to as cereal of the future for its nutritional value and utilization of its products and by-products (Suleiman, Rosentrater, Bern, 2013). Maize is an annual plant with high productivity which also enjoys exceptional geographic adaptability and an important property which has helped its cultivation to spread throughout the world (Adebisi, Owolade and Jatto, 2015). It is a basic staple food grain for large parts of world including African, Latin America and Asia. It is normally stored by homesteads essentially for family consumption (Yaouba, Tatsadjieu, Jazet and Mbofung, 2012).

Maize is a major food for most household in Nigeria and the main source of income and employment for the majority of rural household. Maize is a versatile crop that grows across a range of agro-ecological zones which serves as an important source of carbohydrate and if eaten in the immature stage, provides useful quantities of vitamin A and C (Ajani and Onwubuya, 2012). It serves as a raw materials for many finished products. Therefore maize needs to be stored from one harvest to next in order to maintain its constant supply all year round and to preserve its quality, protect it from weather, micro-organisms and insects until it's required for use. (Oyekele, Daniel, Ajala, and Sanni, 2012).

Maize can be stored in different storage structures which includes metal silos, jute bags, platforms, cribs, gourds, storing over fire(aerial storage), metal tanks, concrete tanks, warehouses/rooms/old houses, metal/plastic drums, earthen/metal pots, plastic/metal buckets, rhombus, bottles and tins. Metal silos and warehouses were the predominant structures used for large scale storage while small-scale farmers uses the metal tank followed by cribs for both drying and storage and bags for the storage of maize Mijinyawa, Mwinjilo, and Dlamini (2006). Successful maize storage enable farmers to sell maize when the price are attractive (off-season) and increasing the farmers well-being. But with the existing indigenous storage techniques which may reduce the quality content of maize, makes the market a subject considerable short term and inter-seasonal price fluctuation and also affects the interest of both consumers and producers. Hence, needs to be upgraded. Lack of modern and appropriate storage technologies for storing of grains is a major problem in promoting agricultural development in the country. Most of these new technologies are yet to be

adopted and also very expensive for small scale rural farmers in Nigeria (Adebisi, Owolade and Jatto, 2015). These brings about lapses in shortage in grains supply during off-season despite the efforts made by government to improve food productivity. Storage losses stand as a major problem if food security is to be attained in the country. Thus, there is the need to improve the modern and appropriate technologies needed by maize farmers in order to improve their productivity. Therefore this study was conducted to assess the maize storage techniques utilized by small-scale farmers in Anambra State, Nigeria. The study would therefore provide answers to the following questions; what are the socio-economics characteristics of the maize farmers in the study area?; what methods of storage techniques exist in the area?; what are the reasons for storing maize?; what are the main determinant of maize storage technologies in the area?; and what are the constraints faced by the maize farmers during storage in the area?. Specifically, the study sought to: describes the socio-economic characteristics of the maize farmers in the area; determine methods of maize storage techniques in the study area; ascertain reasons for storing maize in the study area; Estimate the effect of socio-economic factors of the respondents on maize revenue; and identify challenges faced by the maize farmers during storage in the area.

Literature Review

Appropriate grain storage technologies help to demote farmer's spirits to sell their maize when prices are low in order to avoid post -harvest losses from pests and pathogens. This bridges them from using their harvest as collateral to access credit, hence, food security and safe storage needs to be promoted. A study conducted by Oladejo (2016), on economic analysis of maize storage techniques utilized by farmers in Osun State, noted that 49.5% of maize farmers were between 41-50 years while 7.3% were less than 30years. The mean age was 47.08 years. This implies that many of the farmers were still within economically active age. The study revealed that 74.8% of the farmers were male while 25.2% are female, 84.9% are married and the mean household size was found to be 6. The average number of the years spent in school by respondents was 10years and mean farming experience was found to be approximately 18 years with 80% literacy level. The high literacy level observed among the maize farmers is an indication that they can participate efficiently in farming operations as well as managers. They will also be able to record information that will lead to long term planning.

Storage techniques for stored grains are considered an ecological system, it plays a vital role in food supply chain. Jian and Jaya (2012), describe storage as an approach by which grain integrated with other factors such as relative humidity and temperature to promote protection of grain and environment to deliver well quality grains at the end of storage time. They observed that 26.7% do not store at all, 20.2 % make use of jute bags, 2.5% make use of elevated barn, 43.7% make use of cribs, and 2.5% make use of metal drums. 0.8% make use of silo and 3.4% make use of open platform. According to Nukenine (2010) "storage is a way or process by which agricultural products or produce are kept for future use". Suleiman et al (2013) indicated that maize can be stored in three main ways namely; crib, bags and bulk storage these will prevent the maize from rusting and pest attack. Oluwatoba, Jacob, Herbert and Gerald (2016), revealed that woven polypropylene bags, cribs, traditional granaries, improved granaries and hermetic bags were the major methods of maize storage systems. Tefera, Kanapiu, De-Groote, Hellin, Mugo, Kimeju…(2011), succinctly observed that hermetic storage also known as sealed storage or airtight storage is generally gaining popularity as one of the major storage techniques for cereals in

developing countries as a results of its effectiveness and avoidance of the use of chemicals and pesticides. This methods brings about ease of installation, elimination of pesticides use, favourable costs, modest infrastructural requirements are some of the traditional advantages that make the hermetic storage options attractive (Global Harvest Initiative Report (GHIR), 2014).

Storage plays a vital role in the food supply chain because several studies have reported maximum losses happens during maize operation. The indigenous storage structures are made of locally available materials (grass, wood, mud etc) without any scientific design, and cannot guarantee to protect crops against pests for a long time while modern storage techniques are equipped with scientific design and proves to be useful and guarantee to store grains for a long period of time. Efficient storage of produce depends on a number of factors one of which is the availability of the structures to hold the produce. Storage is therefore very important in all circumstances whether there are surpluses or deficits.

Reasons of storing maize depends on the farmer's priority, some store maize base on their individual benefits or commercial purpose. Ajani and Onwubuya (2012) stated that major reasons for storing maize among farmers includes; household consumption (60.0%), generate income (40.0%), avoidance of wastage (36.7%) and acquisition of money during off season period. This implies that the respondents were storing maize in order to feed member of their household. This could be attributed to the fact that maize is a major staple food consumed by most household which can be used for preparing pap, flour and other diets. Another channel through which storage technologies might affect improved input use and production is through increased income. Studies have previously shown that an average household who used hermetic storage technologies increase their income (Gotonga, De Groote, Kassie, and Tefera, 2013). This implies that well-endowed household are more likely to adopt improved maize storage systems. Also, it suggests that there is an implicit connection between storage technology and improved input use.

Costa (2014) succinctly observed that availability of low cost and effective storage structures can motivate farmers to store their grains and obtain higher prices instead of selling right away after harvesting when there is an abundant supply of grains. In a study conducted by Ndegwa, Degroote, GItonga and Bruce (2015) on the effectiveness and economics of hermetic bags for maize storage, noted that 60% of the respondents strongly agreed that the smell, taste, colour and shape were maintained after four months of storage, 35% agreed that the quality was maintained while 5% disagreed. This may suggest the fact that one of the benefits of science and technology in small farmer productivity is that it brings about improvement in income and hence improve their living standard.

The effect of socio-economics factors of the respondents on maize revenue is determine in order to make farmers known their stand after harvesting. Oladejo (2016) on the study of relationship between socio-economic characteristics of respondents, storage decision and maize revenue stated that age and farming experience is significant and coefficient bears a positive sign. This indicate that age and farming experience of the maize farmer has a positive effect on storage and revenue of the farmers. It implies that a respondent's advance in age, there is higher probability of deciding to store some or all of the produced grains for future use or sale. Also respondents with high farming experience has a higher probability of deciding to store for future use instead of selling immediately after harvest. Oladejo (2016) further observed in his study that the relationship between the total revenue and total cost was significant at 1% which shows that the cost of storage

has a positive effect on the revenue generated by the respondents. This established the fact that proper storage is associated with a cost and there is a benefit attached to it at the long run.

There are some factors which hinder some farmers to store maize for future use. According to Ajani and Onwubuya (2012), factors that constraints effective storage of maize includes; poor finance, poor knowledge of preservation materials, poor access to proper storage facilities, high cost of farm inputs, lack of market for produce, etc. Oladejo (2016) reported that the major constraints faced by his respondents on analysis of maize storage techniques utilized by farmers in Osun state, Nigeria were pests and diseases. This is similar to the observation of Kaminski et al., (2014) who reported that insect infection was found as one of the major reason of reason of storage losses in most developing countries. Therefore these factors needs to be trapped down for the progress of grain storage in the life of the maize farmers.

Transportation is an important operation of the grain value chain as commodities need to be moved from one step to another, such as field to processing facilities, to storage facilities and to market. The lack of adequate transportation infrastructure result in damage of food products through bruising and losses due to spillage as observed by Kumar and Kalita, (2017). They further observed that transportation is relatively very low in developed countries due to better road infrastructure and engineered facilities on the field and processing facilities to load and unload the vehicles rapidly with very little or no damage.

MATERIALS AND METHOD

The study was carried out in Anambra State, Nigeria. The State comprises twenty one (21) local government areas, 177 autonomous communities and four (4) agricultural zones (Aguta, Anambra, Awka and Onitsha). The State is located between latitudes $6^{0}36^{1}$ E and $7^{0}21^{1}$ W and longtitude $5^{0}38^{1}$ N and 6^{0} 47^{1} S. The state has two main season rainy and dry season and located in the humid tropical rain forest zone. The climate of the state is comparatively good with a mean temperature of 30^{0c} during the hottest period of February to April and 21^{0c} during the coldest period of December to January. Anambra State has Abia, Delta, Enugu, Imo and Kogi State as its neighbouring States. The major rivers within the state includes river Niger, Omabala river, Ezu-river, Obinna river and other river lets, thus, providing water for the cultivation of lowland and upland arable crops in the state. The state has an estimated population of 4,182,032 and a land mass of 4.416square kilometers with male population of 50.9% and female 49.1% (National Population Commission, NPC, 2006). 70% of the total land area is used for agricultural purposes. The major occupation in the state is farming and trading. The state has other many resources in terms of agro-based activities such as fisheries and farming as well as land cultivated for animal husbandry.

The population for the study comprised all maize farmers in Anambra State. A Multi stage sampling technique was used to select 120 respondents. Stage 1 involved purposive selection of two (2) agricultural zones, which includes Akwa and Anambra agricultural zones due to their serious engagement in farming, blessed with fertile soils and had a favourable climate which makes them to be the food basket of the state. Stage II involved simple random selection of three (3) extension blocks each from the selected zones to give six (6) blocks selected.

In stage III, two (2) circles were selected from each of the selected blocks using simple random sampling technique to give 12 circles selected. Stage IV involved simple random selection of ten (10) maize farmers in each of the selected circles, giving a total of 120 respondents for the study.

Questionnaires were administered through structural interview schedule to source the relevant information from the maize storage farmers. The interview schedule used for the data collection were divided into 4 sections based on the objectives. Section A dealt with socio-economic characteristics of the farmers; section B sought information on the method of storage techniques used by the maize farmers; Section C elicited information on the reasons for storing maize; Section D obtained information on the constraints to the effective storage of maize.

The instrument for data collection were validated by lecturers in the Department of Agricultural Economics and Extension, Chukwuemeka Odumegwu Ojukwu University (COOU). One hundred and thirty questionnaire were distributed to the respondents with the help of 12 well trained extension agents from the study area. However 120 questionnaire were properly filled and used for the study.

The variable for the study were measured as follows;

To identify the socio-economic characteristics of the farmers, respondents were asked to indicate their age, sex, marital status, level of education, household size, farming experience, annual income, and length of storage, extension contact, and membership of farmers' organization. To identify the method of storage techniques used by the maize farmers; the respondents were asked to indicate the method of storage technique available in the area. This includes; cribs, jute bag, open platform, elevate barn, metal drum, hermetic method and no storage. To ascertain the reasons for storing maize; the respondents were asked to indicate reasons for storing maize. This includes; household consumption, increased annual income, improved living condition, better quality of produce, retain taste, avoidance of waste and price increase during off-season period.

To determine the effects of socio-economic characteristics of the respondents on maize revenue; regression analysis was used to analyze the data generated. The regression model is specified as follows;

$Y = a + b_1X_1 + b_2X_2 + b_3 X_3 + b_4X_4 + b_5X_5 + \mu$

Where Y = revenue (dependent variable)

a = constant term

$b_1 – b_5$= regression coefficients

X_1 = age (years)

X_2 = sex (male = 1, female =2)

X_3 = years spent in school; (years)

X_4 = farming experience (years)

X_5 = household size (number of persons)

μ = error term

To identify the constraints militating against effective storage of maize; the respondents were asked to indicate the constraints using a 3 likert-type scale of not serious =1, serious =2 and very serious =3. The mean cut-off point of 2.0 was adopted as the measure of determining the levels of each variables on maize storage techniques utilized by the small-scale maize farmers in the study area. Data for the study were collected using questionnaire/interview schedule. Descriptive statistic and multiple regression were used for data analysis.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

Data in table 1 showed that majority (33.3%) were between 41-50 years, 26.7% were between 31-40 years, 20% were between 51-60 years, 11.7% were between 21-30 years and 8.3% were between 61 years and above. The mean age of the farmers was 43.8. This indicates that majority of the farmers were in their productive ages, hence highly engaged in maize production. The result in table 1 also indicated that 65.8% of the respondents were female while 34.2% were male, showing that female dominated the maize storage activities in the study area. This could be as a result of higher incidence of female headed households. They store maize to be sold during off season which enhances improvement in family food security and increased financial contribution to household needs. This could be attributed to the significant roles women play in food production and food security. Hence, enhanced improvement in financial household needs.

Entries in table 1 showed that majority (67.5%) of the farmers were married, 17.5% were widowed, and 13.3% were single while 1.7% were divorced. This implies that most of the respondents were married, hence greater involvement in maize storage practices for future consumption for household members. Also the study indicated that majority (33.3%) had secondary school education, 30.0% attended primary school, 20.0% of the respondents never had any form of formal education and 16.7% had tertiary school education. Education is necessary in the life of a farmer. At least more than half of the respondents had the basic education which will help them participate fully in farm operations, keeping farm records and knowing the costs and return of maize storage will help them improve in storage activities for the betterment of their living.

Greater proportion (45.8%) of the respondents had fairly large family size of 6-10 members, 41.7% of them had between 1-5 members, 10.0% of them had between 11-15 members while 2.5% of them had between 16-20 members. The mean family size was 7 persons. Thus, large family size constitutes the family labour which most of the respondents rely upon in carrying out certain tasks in the maize storage activities (Ajani and Onwubuya, 2012). Also the study indicated that majority of the respondents 70.8% belonged to 3-4 farmers' organizations while 29.2% belonged to 1-2 farmers' organization. This implies that the farmers that belonged to farmers' organization increased their awareness through extension education as well as sharing ideas enjoyed by being in a group. Nenna (2012) observed that 'high level of participation in farmers' organization and interaction increases awareness of innovation among the farmers due to group dynamic effect.''

Most of the respondents 45% had between 11-20 years of farming experience in participating in maize storage while 30.0%, 14.2%, 8.3% and 2.5% had between 1-10 years, 21-30 years, 31-40 years and above 41years of farming experience respectively. The mean farming experience was

16 years. This shows that most of the farmers have been exposed to a certain maize storage technique, thus having relative experience in some of the processes involved in storing maize.

The result on the annual income showed that 46.7% of the respondents earned between N51, 000- N60, 000 per annum. 30.0% of the respondents, 14.2% of the respondents, 5.8% of the respondents, and 3.3% of the respondents earned between N41,000- N50,000, N61,000 and above, N31,000- N40,000 and N21,000- N30,000 per annum of their income respectively. The mean annual income was N511.13. This implies that most of the farmers will have income at hand which encourages them to continue farming in the next farming season, hence income is one of the major determinants of any business venture. Further result from the analysis showed that majority (58.3%) of the respondents stored their produce between 1-6 months, 27.5% do not store at all while 14.2% stored their produce between 7-12 months. The average storage period was 3.7 months. This implies that farmers do not store maize for a long period due to their subsistence nature and fear of deterioration during storage. The study further showed that majority (70.8%) of the respondents had extension contact 1-4 times within maize storage period. 26.6% of the respondents, 2.5% of the respondents had extension contact within 5-8 times and 9 times and above respectively within the maize storage period. The mean extension contact was 3.7 times. This implies that extension workers which is the frame work of adoption of improved technologies among farmers are not living up to their responsibilities in discharging their duties in the study area. Edeoghon and Idele (2012) succinctly observed that improved technology dissemination is vested on extension agents to transfer the knowledge to the target farmers, thereby increasing farmer's productivity and storage.

Variables	Frequency	Percentage	Mean
Age (years)			
21 – 30	14	11.7	
31 – 40	32	26.7	
41 – 50	40	33.3	43.8
51 – 60	24	20.7	
60 and above	10	8.3	
Sex			
Male	41	34.2	
Female	79	65.8	
Marital status			
Single	16	13.3	
Married	81	67.5	
Widowed	21	17.5	
Divorced	2	1.7	
Level of education (years)			
No formal education	24	20.0	
Primary school	36	30.0	
Secondary school	40	33.3	
Tertiary institution	20	16.7	
Household size (number of persons)	50	41.7	
1 – 5	55	45.8	7
6 – 10	12	10.0	
11 – 15	3	2.5	
16 – 20			
Membership of farmers' organization	35	29.2	
1-2	85	70.8	
3-4			3.0
Farming experience (years)			
1 – 10	36	30.0	
11 – 20	54	45.0	
21 – 30	17	14.2	16.2
31 – 40	10	8.3	
41 and above	3	2.5	
Annual income (N)			
21,000 – 30,000	4	3.3	
31,000 – 40,000	7	5.8	
41,000- 50,000	36	30.0	51,113.0
51,000-60,000	56	46.7	
61,000 and above	17	14.2	
Length of storage (months)			
No storage	33	27.5	

1 – 6	70	58.3	3.7
7 – 12	17	14.2	
Extension contact			
1 – 4	85	70.8	
5 – 8	32	26.7	3.7
9 – above	3	2.5	

Table 1: Distribution of the respondents according to socio-economic characteristics (n=120)

Source: Field survey, 2018

Methods of Storage Techniques

Table 2 showed the various storage technique used by the maize farmers in the study area. The results showed that majority (80.0%) of the respondents stored their maize using cribs, 60.0% used jute bag, 43.3% used open platform, 33.3% used metal drum, 31.7% used elevated barn, 28.3% did not store at all while 2.5% used hermetic method for maize storage. This implies that the respondents are gradually graduating from the use of traditional storage techniques to modern techniques as observed by (SWISS Agency for Development and Cooperation (SADC), 2008). Hermetic method of storage was the least method of maize storage in the study area but it is still new in the country. Suleiman, Rosentrater, and Bern, (2013) observed that hermetic methods of maize storage is the most effective and appropriate for subsistence farmers because it eliminate the need for insecticides, which are costly and often inaccessible to farmers and it is just gaining popularity in developing countries, Nigeria inclusive.

Table 4.2: Distribution of the respondents according to the method of storage techniques (n=120)

Variables (methods of storage)	Frequency	Percentage
Cribs	96	80.0%
No storage	34	28.3%
Jute bags	72	60.0%
Open platform	52	43.3%
Elevated barn	38	31.7%
Metal drum	40	33.3%
Hermetic method	3	2.5%

Source; Field survey, 2018
Multiple responses recorded

Reasons for Storing Maize

The table 3 showed the reasons for storing maize. The result revealed that majority (80%) of the respondents stored their maize products for household consumption, 66.7% stored to increase their income, 55% stored to improved their living standard, 54.2% stored for better quality of produce, 51.7% stored to retain taste of the maize while 22.5% stored to increase price during off-season. From the results, majority stored for household consumption and to increase their income. This may be as a result of the maize farmers in the study area take maize as one of their staple food which may be consumed based on its different varieties like preparing pap, flour etc. Also income generated may be used to solve other family problems. This is supported with the findings of Ajani and Onwubuya, (2012) who attributed that maize is one of a staple food consumed by people based on its varietal uses in essence of providing nutrients to their body.

Table 4.3 Distribution of the respondents according to reasons for storing maize

Reasons	Frequency	Percentage
Household consumption	96	80.0
Increased annual income	80	66.7
Improved living condition	66	55.0
Better quality of produce	65	54.2
Retain taste	62	51.7
Avoidance of waste	44	36.7
Increased price	27	22.5

Source: Field survey, 2018
Multiple responses recorded

The Effects of Socio-economic Factors of the Respondents on Maize Revenue

Table 4 showed the relationship between total revenue which is the dependent variable and the explanatory variables (independent variables). The adjusted R^2 is 0.823 which implies that 82% of the variation in the revenue generated was explained by the explanatory variables included in the model. Farming experience (X_5) is positively correlated but not significant at any probability level.

Storage cost(X_2) of maize was positively correlated and statistically significant at 1% which shows that the cost of storage has a positive effect on the revenue generated by respondents. This established the fact that proper storage is associated with a cost but there is a benefit attached to it at a long run. This is due to the fact that total revenue increases as a result of the respondent selling the stored maize during the off season when the price is higher. Storage technique (X_4) is positively and significantly correlated with revenue and significant at 5% probability levels. This implies that respondents using improved techniques generates more revenue in the study area. The result is in agreement with the findings of Oladeji (2016), who noted that there is a significant relationship

between total revenue and the cost of storage. Period or length of storage (X_6) was also positively and statistically significant at 5%, which implies that the longer the length of storage, the higher the revenue by respondents. The remaining three variables were found not to be significantly related with the revenue generated by respondents.

Table 4: Relationship of total revenue earned by the farmers and the cost of storage

Variable	Coefficient	T-value	Significant remark
Sex (X_1)	-0.263	-0.521	Not Significant
Storage cost (X_2)	0.636	2531***	Significant at 1%
Transport cost (X_3)	-0.046	-0.858	Not Significant
Storage techniques (X_4)	0.072	0.387**	Significant at 5%
Farming experience (X_5)	0.387	1.507	Not Significant
Period of storage (X_6)	0.356	0.204**	Significant at 5%

Note $R^2 = 0.823$
Computed from field survey data, 2018.

Constraints to effective storage

The result in table 5 showed the factors that hindered the farmers in engaging in storage activities. Major constraints to effective storage of maize include pests and diseases (m = 2.92), lack of modern storage methods and management (m = 2.83), lack of extension agents (m = 2.75), lack of finance (m = 2.73), transportation (m = 2.58) and lack of access to modern technology (m = 2.57). This implies that farmers were highly constrained with attack of pests and diseases toward there produce. This finding is agreement with Kaminski and Christiansen (2014) who reported that insect infestation was found to be the major reasons for storage losses in most developing countries. Third constraint was lack of information between the extension agents and farmers. This can be attributed to the fact that extension agents plays a pivotal role in the provision of different agricultural information and adoption of technologies that will promote the utilization and increase of farmers yield but failed. This was supported by Nenna (2011) who observed that extension services bear great potentials for improving the productivity of natural resources, promoting the right attitude among natural resources managers. He further stated that extension service is equally recognized as an essential mechanism for information delivery and advice as input, into modern resource management. Lack of transportation (m= 2.58) brings about food products spoilage. The results shows that farmers find it difficult to transport their produce to various locations. Oladejo (2016) sate that transportation is an important operation of the grain value chain as commodities need to be moved from one step to another. Security (m = 1.25), labour (m = 1.42) and Theft (m = 0.42) are the minor constraints that affect farmers during storage period.

Table 5: Distribution of respondent according to constraints to effective storage of maize

Constraint	Mean	Rank
Lack of modern storage method and management	2.83	2nd
Pest and diseases	2.92	1st
Lack of extension agents	2.75	3rd
Lack of finance	2.73	4th
High cost of farm produce	2.57	6th
Transportation	2.58	5th
Labour	1.42	7th
Security	1.25	8th
Theft	0.42	9th

Source; Field survey, 2018
Multiple responses recorded

Conclusion and Recommendation

This study attempted to assess the maize storage techniques utilized by small-scale farmers in Anambra, Nigeria. Storage is a complex problem due to losses experienced during the process. However, it differs from crops, practices and climatic conditions of countries to another. It affects farmers' livelihood negatively due to losses in quantity and quality of the products as a result of pests and insects. Technological innovations and improved maize storage techniques can play a critical role in addressing storage losses and increase farmers financial base. Using proper agricultural practices can reduce significantly the losses and help in strengthening food security and poverty alleviation among small-scale maize farmers. Despite the little benefits maize farmers derived from the use of available maize storage structures, one of their constraint is still lack of storage methods and management. Therefore Government should train, enlighten and motivate farmers towards the use of modern storage facilities in order to reduce losses of postharvest. Extension should be equipped, trained and readily available to maize farmers in order to educate them on how to store their maize for better future use. Also maize farmers should be encouraged to have easy access to loans in order to upgrade their farming activities.

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