Original Research Article

Analysis of post-harvest losses of yam in North-East Zone of Benue State, Nigeria

ABSTRACT

The study analyzed the post-harvest losses of yam in North-East Zone of Benue state, Nigeria. It ascertained the level of postharvest losses of yam, identified the factors precipitating postharvest losses of yam identified the strategies adopted by yam farmers for reduction of postharvest losses of yam in North-East Zone of Benue State, Nigeria. The study consisted of a total sample size of two hundred and four (204) yam farmers drawn from three local government areas of North-East Zone of Benue state. The result identified pest attack, storage method, temperature, disease and infection, poor transportation, theft, underdeveloped market and exposure of yam to sunlight as factors precipitating post-harvest losses in the area. It also shows the result of the assessment of yam farmers in the study area regarding the level of losses they experience at various stages of yam postharvest activities. The value of the coefficient of multiple determinants (R^2), is 0808, which implies that about 80.8% of the postharvest losses of yam in the study area is explained by the explanatory variables included in the model. The F-statistic of the lead equation is significant at 1% (28.122). Coefficients of pest attack disease and infections of yam, poor transportation facility, poor handling method used, excessive exposure of yam to sunlight, werepositively related to postharvest losses of yam in the study area at 1% level of significant. Coefficient of storage method, temperature of the area and theft of yam in the study area were positive and significant to postharvest losses of yam at 5% level of significant. Given that, the computed F-value (28.122), was significantly higher than the tabulated F-value (9.33), at 1% level of significance, and (3.11) at 5% level of significance; the null hypothesis was therefore rejected and the alternative hypothesis was accepted. The study recommends provision of yam flour processing factory, which will provide a ready yam market that will reduce postharvest losses of yams and also increase the economic value of yams in the area.

Introduction

The phenomenon of postharvest losses of crop is an issue of great concern in the global community. This is essentially because, about one-third of the food produced in the world for human consumption every year, which is approximately 1.3 billion tones gets lost after harvest (FAO, 2018). By implication, 30% to 40% of all food crops produced in the world for human consumption is never consumed due to quantitative and qualitative losses, which occur as food crop passes through postharvest chain or system.

Postharvest loss of food means the measurable quantitative and qualitative food losses in the postharvest chain or system. The postharvest system comprises of interconnected activities from the time of crop harvest through storage, processing, marketing and preparation, to the final decision by the consumer to eat or discard the food (Kiaya, 2014). Qualitative food losses involve alteration in the physical condition or characteristics of food produce which affect the nutrient/caloric composition and the edibility of the food produce while quantitative food losses involve losses in terms of volume or amount of food product. It is worthy of note that quantitative food loss in the postharvest food chain is more common in developing countries, including Nigeria and Benue State (Kitinoja & Gorny, 1999). Quantitative and qualitative food losses do occur at any stage in the postharvest chain. Also, economic losses can occur, as a subset of postharvest loss, in the event where the produce is subsequently restricted to a lower market value due to either the qualitative or quantitative loss. When this occurs, the income of the producers and/or produce marketers is directly affected. This can invariably affect their capacity to be effective in the next food production season and thereby, ensure continues availability of sufficient and quality food for their households.

Benue state is acclaimed the largest producer of yam in Nigeria and West Africa at large (Phillips, Ogbonna, Etudaiye, Mignouna & Siwoku, 2013:15), with the largest yam market (Zaki Biam yam market) in Benue North-East Zone and other numerous yam markets across the state. The foregoing indicates a high level of yam production and yam marketing activities in Benue and North-East Zone of Benue State in particular. This prospect raises the general expectation that, the available yam markets should provide an avenue whereby yam farming households can sale surplus yam produce so as to generate enormous financial income, which will translate into a good standard of living and also ensure the continuous availability of sufficient quality food for household consumption.

However, the findings of Verter and Becvarova (2014), Ivanda, Igbokwe and Olatunji (2015) and Abu and Soom (2016), on the condition of farming households in Benue, reveals that over 30% of yam farming households in Benue are still experiencing low income from yam production and food insecurity. This findings suggests that, there might

be a prevailing significant level of postharvest losses of yam which may have been negatively affecting the standard of living and food security of yam farming households in North-East Zone of Benue State. Again, several studies such as: Gernah, Ukeyima, Ikya, Ode and Ogunbande (2013), Adamu, Mada and Kabri (2014), Sanginga and IITA (2015), FAO (2018) and even studies that have been situated in the study area like: Verter and Becvarova (2014), Ivanda, Igbokwe and Olatunji (2015) and Abu and Soom (2016) have not established the factors precipitating postharvest losses of yams in the study area, strategies adopted by yam farmers to reduce postharvest losses of yam, the level of the losses of yam farming households in the study area.

Objectives of the study

The foregoing underscores an existing knowledge gap that needs to be filled. Hence the study:

1. ascertained the level of postharvest losses of yam,
2. determined the factors precipitating postharvest losses of yam and
3. identified strategies adopted by yam farmers for reduction of postharvest losses of yam in North-East Zone of Benue State, Nigeria.

Hypothesis

Pest attack, poor storage, temperature, disease and infections, long distance from farm to yam barn/market, poor transportation facility, theft, poor handling, sprouting, destruction from crises, underdeveloped market and excessive exposure of yam to sunlight are not factors precipitating postharvest loss of yam in North-East Zone of Benue State, Nigeria.

Materials and Methods

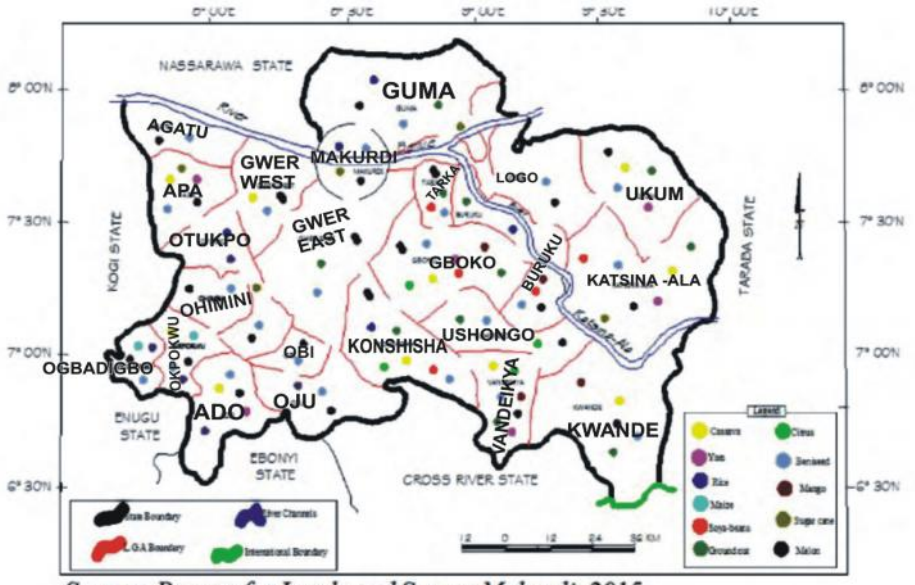
The study area is Benue North-East Zone. This zone was established as a geo-political demarcation alone side Benue North-West Zone and Benue South Zone. The Benue North-East Zone, other words known as Zone A, is comprised of seven Local Government Areas namely: Kwande, Logo, Vandeikya, Katsina-Ala, Konshisha, Ukum and Ushongo. The population of Benue North-East Zone is estimated at 3,234,660, whereas, an estimated figure of 285,454 has been recorded as regular households in the

Zone (National Population Commission, 2009). The State lies roughly within the lower river Benue in the middle belt region of Nigeria, lying between Latitudes 6.5° and 8.5° North and Longitudes 7.47° N and 10^0 East.

Figure 1: Map of Benue State Showing Distribution of Local Government Areas by Zones

Source, Bureau for Lands and Survey Makurdi, 2015

Figure 2: Crop Production map of Benue State



Source: Bureau for Lands and Survey Makurdi, 2015.

The population of study consists of all yam farming households in North-East Zone of Benue State, Nigeria made up of seven (7) Local Government Areas. The study purposively selected three (3) local government areas (Ukum, Katsina-Ala and Logo) that are most prominent in yam production in North-East Zone of Benue State. The three Local Government Areas have a total of 1735 yam farming Households (Yam Farmers Association, 2018). Four (4) council wards were randomly selected from each of the selected local government areas, then seventeen (17) respondents were selected from each of the council wards. This gave a total sample size of two hundred and four (204) respondents. Primary data was obtained from fieldwork using questionnaire and focused group discussion methods. Descriptive statistics were used to achieve the objectives of the study while multiple regression analysis were used to text the hypothesis of the study

Model Specification

For Hypothesis 1 we specify multiple regression model thus;

Mathematical approach of the model;

$$Y = F(X_1,X_2X_3,X_4,X_5,X_6,X_7,X_8,X_9,X_{10},X_{11},X_{12}) \quad (1)$$

Econometric approach of the model;

Linear model;

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+ei \quad (2)$$

Exponential model;

$$LogY=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+ei \quad (3)$$

Semi-log model;

$$Y= \beta_0+\log \beta_1X_1+\log\beta_2X_2+\log\beta_3X_3+\log\beta_4X_4+\log\beta_5X_5+\log\beta_6X_6+\log\beta_7X_7+\log\beta_8X_8+\log\beta_9X_9+\log\beta_{10}X_{10}+\log\beta_{11}X_{11}+\log\beta_{12}X_{12}+ei \quad (4)$$

Double log;

$$LogY=\beta_0+\log\beta_1X_1+\log\beta_2X_2+\log\beta_3X_3+\log\beta_4X_4+\log\beta_5X_5+\log\beta_6X_6+\log\beta_7X_7+\log\beta_8X_8+\log\beta_9X_9+\log\beta_{10}X_{10}+\log\beta_{11}X_{11}+\log\beta_{12}X_{12}+ei \quad (5)$$

Where;

Y = Yam Post-harvest loss (qtg)

X_1 = Pest attack; X_2 = Poor storage and processing facilities; X_3 = Temperature of the area; X_4 = Diseases and infections; X_5 = Long distance from farm to yam barn/market; X_6 = Poor transportation facilities; X_7 = Theft of yam; X_8 = Poor handling of yam; X_9 = Sprouting; X_{10} =Destruction due to crisis; X_{11} = Underdeveloped market; X_{12} = Excessive exposure of yam to sunlight; b_0 = intercept; $b_1 – b_{12}$= parameters estimate; ei = error term,

Result and Discussion

Factors Precipitating Postharvest Losses of Yam in North-East Zone of Benue State

Table 1: Factors precipitating postharvest losses of yam in North-East Zone of Benue State

Variables	Frequency	Percentage
Pest Attack	198	97
Storage method	202	99
Temperature	192	94
Disease and Infection	102	50
Distance	98	48
Poor Transportation	164	80
Theft	92	45
Handling of yams	182	89
Sprouting	68	33
Destruction from Crises	192	94
Underdeveloped Market	168	82
Exposure of Yam to Sunlight	201	99

Source: Field Survey, 2018. NB: *Multiple response table*

The result on table 1 shows the opinion of yam farmers on factors that precipitate postharvest losses of yam in the study area. The result reveal that storage method used 99% (202) is the major cause of postharvest losses of yam in North-East Zone of Benue State. All the Focused Group Discussants in both Logo and Ukum Local Government Areas also submitted unanimously that poor storage is a major factor that precipitates postharvest loss of yam along other factors such as: poor handling method, destruction from crises, attack by pest, theft and fire disaster. The discussants noted accordingly that,

the major storage method employed in the study area is the barn, which is basically a traditional method of yam storage. Many of the discussants in both groups however, had little knowledge about modern/improved methods of yam storage. This is consistent with the findings of Osunde (2008), MFCL et al. (2004), Opara (2003) and FAO (1998) that, yam barn is the principal traditional yam storage structure in the yam producing areas, including Nigeria and Benue State.

The result on table 1 also reveals that, storage operations of yam farmers in the study area may have been characterized by poor storage management in which case, they usually fail to effectively monitor by regular inspection so as to prevent pest attack 97% (198) on their stored yams and also reduce temperature 94% (192) in the barn so as to prevent yam rot. This finding is in agreement with the findings of Opara (2003) on "yams postharvest operation" by which he identified three main necessary conditions for successful yam storage, which will involve minimal losses and they include: ventilation, reduction of temperature and regular inspection of the stored yam. The following submission by a discussant from Mbater council ward in Logo Local Government Area brings to light the reason for yam losses during storage in the study area:

> "For me, I usually get large yam harvest and I also store many yams, mostly in the barn, arranged in hips on the ground. So, regular checking on the yams becomes a problem and as a result, many times I notice pests like termites and rats attack my yams and even diseases also affects the yams".

Again, the result on table 1 indicates that exposure of yams to sunlight 99% (201) is another major cause of postharvest loss of yam in the study area as almost all of the sampled respondents concurred to this opinion. It is clear from this result that, such

exposure may have begun right at the time of harvesting where, following poor handling 89% (182), yams are left under the sun for a long time especially in situations where there is shortage of work force during harvest. Understandably, therefore, when yams are exposed to sunlight in this manner and days after on account of yam curing practice, there is always a tendency for yam rot and hence losses. This is because, the length of time for proper curing cannot be precisely defined (FAO, 1998) and it depends on several factors such as: condition of the yam at harvest, season and temperature of the environment. When these factors at harvest and during yam curing are not effectively controlled, exposure of yam to sunlight at harvest and during yam curing can easily become excessive and thus yam rot and loss will be inevitable.

Furthermore, excessive exposure of yam to sunlight, which precipitates yam losses in the study area, occurs at the market setting. Given market activities of off-loading and loading of yams in the sun and the underdeveloped physical market structures in which yams are stored in the market for transaction, yam rot and losses becomes inevitable. This situation is captured in figure 4.1 below:

Figure 4.1: Loading of yams under the sunlight at Ukum yam market

Source: Field survey, 2018.

Interestingly, virtually all of the discussants in Logo Local Government Area unanimously submitted that, the underdeveloped market structures provide ground for market security persons to steal yams that are kept under their watch. That, one day of security watch equals to one yam loss. The discussants averred that, this situation usually compels yam farmers who sell their yams at the market to dispose their yams at subsided rates, so as to avoid high economic loss. This establishes therefore, that yam losses are incurred from theft 45% (92) as a result of underdeveloped market structure 82% (168) in the study area.

Table 1 also reveals that destruction from crises 94% (192) is another factor, which precipitates postharvest loss of yam in the study area. This result has been confirmed by the submission of a discussant from Tswarev ward in Logo Local Government Area that:

> Out of ten wards in Logo Local Government Area, four wards which include: Tombo, Mbagber, Ukemberega/Tswarev and part of Iwuran have been

displaced, due to the herdsmen-farmer crises. Some of the residence and farms are occupied by Fulani. The herdsmen usually attack, destroy and burn yams in the barn and also expose some to their cattle to eat.

This finding corroborates the submission of Silas (2018) from his assessment of the conflicts between Fulani-herdsmen and farmers in Kwara State of Nigeria that, food crops which were cultivated on about 500 hectares of land with an estimated value of N200 million was burned. This agrees with the position of FAO (2000) that, the impact of conflict on agricultural practice, food security and standard of living of rural farmers can be understandably placed in the context of the nature of contemporary conflicts which are increasingly characterized by intra-country conflict, in which case, they are usually fought in the countryside and/or rural areas rather than cities. Therefore, such conflicts tend to have devastating effect on the rural population and agriculture which goes to affect their standard of living including food availability and accessibility. Nevertheless, all the discussants from the two groups were in agreement that many farmers do move out their harvested produce at the rumour of potential attack, thereby, minimizing the level of postharvest loss they incur during crises.

In the final analysis, therefore, it can be seen that factors such as: pest attack, storage method use and poor storage management, excessive exposure of yams to sunlight, destruction from crises, underdeveloped market, poor harvesting methods and temperature seem to be the factors precipitating postharvest losses of yam in North-East Zone of Benue State.

Level of Postharvest Losses of Yam in North-East Zone of Benue State

This section contains analysis of the opinions of respondents on the level of postharvest losses of yams in the study area.

Table 2: Level of postharvest losses of yam during postharvest activities in the 2016/2017 yam farming season in North-East Zone of Benue State

Quantity of Yam Loss (Tubers)	Frequency	Percentage (%)	Level of Losses
Level of Losses during Handling			
1 – 50	181	88.7	Low +
51 – 100	19	9.3	High
101 and Above	4	2.0	Very High
Total	**204**	**100**	
Level of Losses during Storage			
1 – 50	189	92.6	Low +
51 – 100	13	6.4	High
101 and Above	2	1.0	Very High
Total	**204**	**100**	
Level of Losses during Transportation			
1 – 50	182	89.2	Low +
51 – 100	17	8.3	High
101 and Above	5	2.5	Very High
Total	**204**	**100**	
Level of Losses during Sorting			
1 – 50	180	88.2	Low +
51 – 100	20	9.8	High
101 and Above	4	2.0	Very High
Total	**204**	**100**	
Level of Losses during Marketing			
1 – 50	17	8.3	Low
51 – 100	186	91.2	High +
101 and Above	1	0.5	Very High
Total	**204**	**100**	
General Average loss=10.5%			

Source: Field Survey, 2018.

Table 2 shows the result of the assessment of yam farmers in the study area regarding the level of losses they experience at various stages of yam postharvest activities such as: harvesting, storage, transportation, sorting and marketing. The result revealed that greater losses are incurred during marketing of yam. This is an indication that there are no

readily available markets and that farmers are not linked to buyers. This confirms the assertions of Nwafor *et al.* (2019) that farmers are in need of market linkages. The high level of losses during marketing could also be for the fact that farmers find difficult to carry their produce home at the close of the day, instead they chose to dispose it at any price or better still abandon them in the market place in other not to spend another money carrying them home. This calls for an organized marketing extension services in the area. This result is consistent with findings of Nwafor *et al.* (2019) that reduction in the volume of postharvest losses of root and tuber crop production is dependent on the agricultural marketing extension services available to farmers in the study area.

Majority of the farmers experienced low level of losses during other activities except marketing. This could be because of many years of experience and constant practice. The farmers over the years have learnt to carry out yam production activities with minimal losses. Handling of yams cuts across all other postharvest activities mentioned above. There is no gain therefore, saying that, the manner by which yams are handled , especially during harvesting, which is an activity that necessarily precedes other postharvest activities can have serious implication for virtually all the postharvest activities that follows. Improper handling of yams during harvest like leaving harvested yams under the sunlight for a long period may predispose yams to easy bruising or injury during yam transportation and sorting.

This finding confirms the findings of Ahmed and Rustagi (1987) from their study on marketing and price incentives in Africa and Asian countries that, food marketing by farming households in Nigeria mostly in the immediate postharvest period usually involves a lot of costs.

Strategies Adopted by Yam Farmers to Reduce Postharvest Losses of Yam in North-East Zone of Benue State

Table 3: Strategies adopted by yam farmers for reduction of postharvest losses of yam in North-East Zone of Benue State

Opinion	Frequency	Percentage (%)
Adoption of modern storage facilities		
Not at All	22	10.8
Sometimes	92	45.1
Oftentimes	46	22.5
Always	44	21.6
Total	**204**	**100**
market linkages and farm-gate selling		
Not at All	56	27.5
Sometimes	51	25.0
Oftentimes	71	34.8
Always	26	12.7
Total	**204**	**100**
curing after harvest		
Not at All	29	14.2
Sometimes	67	32.8
Oftentimes	37	18.1
Always	71	34.8
Total	**204**	**100**
Application of Fungicide and Pesticide		
Not at All	9	4.4
Sometimes	77	37.7
Oftentimes	63	30.9
Always	55	27.0
Total	**204**	**100**

Source: Field Survey, 2018.

The strategies adopted by yam farmers for reduction of postharvest losses of yams in the area included adoption of modern storage facilities. 45.1% (92) of the yam farmers sometimes adopt modern storage facilities. 22.5% (46) oftentimes adopt modern storage facility, whereas, 21.6% (44) maintained that they always used it. Only 10.8% (22) of the yam farmers submitted that they do not use modern storage facilities at all. The result implies that the adoption or continuous use of modern storage facilities is low in the area as only 27% have adopted and hence use them consistently. This could be due to the expensive and complex nature of the modern storage facilities.

The result shows that 34.8% (71) of the yam farmers in the study area oftentimes try to link-up with buyers or otherwise sell at farm gate prices to avoid spoilage. This is an indication that farmers are in need of market linkages. Linking farmers to potential buyers or processors and consumers is a vital strategy of minimizing post-harvest losses of yam. The regrettable consequence of adopting this measure is that, yam farming households turn to incur economic loss, as they do not always get the benefit of the full value of the yams they produce. This situation was captured in the opinion of a group discussant from Tswarev in Logo Local Government Area that:

> "For me, I am happy that my yams stay in the ground till maturity, but I cannot take the risk to store them because I don't know the next thing that will happen, whether Fulani will attack or something else and because of the many money problems, I just sell the yams once I harvest them at the farm. Although it is painful to me because I know that these middlemen will end up benefiting more than me on these yams, but do I have another choice?"

The implication is that many of the farmers adopt sell at farm-gate as a measure to reduce postharvest losses of yams, despite their awareness of the possible postharvest losses

involved in terms of economic losses, which may have adverse implication of adopting such strategy for the standard of living of their households.

The result revealed that majority of yam farmers in the study area applies curing method, fungicide, and pesticide as a strategy to reduce postharvest loss of yams. This may also explain the low level of losses of yams in the study area. The use of pesticides controls attack by pests like rodents, especially in storage facilities or structures such as the barn, which has no anti-rodent guard fitted to it as it is with the case of elevated shade store. Given that one of the main structural problem with the yam barn storage method is that, disease causing fungi and pest can easily attack stored yams, it becomes reasonable and safe to conclude that the prominent use of yam barn method for yam storage in North-East Zone of Benue State warrants the application of fungicide and pesticide as a measure for the reduction of postharvest losses of yams.

Test of Hypothesis

The result of the ordinary least square multiple regression analysis used to test the hypothesis that, pest attack, storage method, temperature, disease and infections, long distance, poor transportation facility, theft, poor handling, sprouting, destruction from crises, underdeveloped market and excessive exposure of yam to sunlight are not factors precipitating postharvest losses of yam in North-East Zone of Benue State is presented in table 4 below.

Table 4: Factors precipitating postharvest losses of yam in North-East Zone of Benue State

Variables	Linear	Exponential	Semi-log+	Double-log
Constant	29.687	1.557	0.784	1.636
	(2.047)**	(13.263)***	(1.995)**	(12.257)***
Pest Attack	-0.744	-0.010	-11.331	-0.144
	(-2447)*	(-0.817)	(5.835)***	(-1.320)
Poor Storage	-1.602	0.021	-0.861	0.265
	(4.553)***	(1.941)**	(2.174)**	(2.968)***
Temperature of the Area	-3.576	0.006	1.916	-0.046
	(3.114)***	(0.600)	(2.444)**	(-0.457)
Diseases and Infections	2.797	0.016	-0.257	0.059
	(1.142)	(0.826)	(3.096)***	(0.448)
Long Distance	-0.560	-0.009	-0.787	-0.039
	(-0.379)	(-0.719)	(-0.060)	(-0.378)
Poor Transportation facility	2.355	0.040	29.962	-0.397
	(1.184)	(2.492)**	(2.300)***	(3.881)***
Theft of Yam	-4.119	-0.039	-23.210	-0.224
	(-3.476)***	(-4.051)***	(2.206)**	(-2.708)*
Poor Handling of Yam	-0.177	-0.004	-2.859	-0.087
	(-0.418)	(-1.089)	(8.716)***	(-1.184)
Sprouting	-0.280	-0.003	-11.289	-0.163
	(-0.854)	(-1.180)	(-1.340)	(-2.472)***
Destruction from Crises	-0.111	-0.001	-5.018	-0.020
	(-0.854)	(-0.519)	(-0.937)	(-0.485)
Underdeveloped Market	0.143	-0.001	-0.738	-0.058
	(0.245)	(-0.203)	(-0.076)	(-0.757)
Excessive exposure of yam to sunlight	0.099	-0.001	3.892	0.040
	(-0.283)	(-0.343)	(5.317)***	(0.583)
R^2	0.462	0.789	0.808	0.563
Adj. R^2	0.441	0.771	0.792	0.557
F-ratio	(2.702)***	(14.016)***	(28.122)***	(4.638)***

Source: Field Survey, 2018.

NB: ****, ** and * represents 1%, 5% and 10% level of statistical significance respectively. Figure in brackets are t-values, whereas, the affirmative symbol + represents lead equation*.

Based on the magnitude of the coefficient of multiple determination (R^2), the number of significant variables, the signs of the regression of the entire model as indicated by the F-statistic, the Semi-log model was selected as the lead model. The value of the coefficient of multiple determinant (R^2) is 0.808, which implies that about 80.8% of the postharvest losses of yam in the study area is explained by the explanatory variables included in the model. The F-statistic of the lead equation is significant at 1% (28.122), which implies that the model was well specified. Thus pest attack, storage method used, temperature of

the study area, disease and infections, poor transportation facility, theft of yam, poor harvesting method and excessive exposure of yam to sunlight were observed to be the significant variables precipitating postharvest losses of yam in North-East Zone of Benue State.

Coefficients of pest attack (5.835), disease and infections of yam (3.096), poor transportation facility (2.300), poor handling method used (8.716), excessive exposure of yam to sunlight (5.317); were positively related to postharvest losses of yam in the study area at 1% level of significant. This implies an increase in these variables would lead to increase in postharvest losses of yam in the study area.

The coefficient of storage method used in the area (2.174), temperature of the area (2.444) and coefficient of theft of yam (2.206) in the study area were positive and significant to postharvest losses of yam at 5% level of significant. This implies a direct relationship of the variables with postharvest losses of yam in the study area. Therefore, increase in any of the variables would lead to increase in postharvest losses of yam in the study area.

Given that, the computed F- value (28.122), was significantly higher than the tabulated F-value (9.33), at 1% level of significance, and (3.11) at 5% level of significance; the null hypothesis was therefore rejected and the alternative hypothesis that; pest attack, storage method, temperature, disease and infections, poor transportation facility, theft, poor handling of yams, excessive exposure of yam to sunlight; are factors precipitating postharvest losses of yam in North-East Zone of Benue State was accepted.

Conclusion/Recommendation

The study thus concludes that, pest attack, storage method used, temperature, disease and infections, poor transportation facility, theft of yams, poor handling of yams and excessive exposure of yams to sunlight are the factors precipitating postharvest losses of yams in the study area. The study recommends yam flour processing factory in the study area, which will provide a ready yam market that will reduce postharvest losses of yams and also increase the economic value of yams, both government and private investors should take a business opportunity by building yam flour processing factory(s) in the study area.

Refernces

Abu, G.A. and Soom, A. (2016).*Analysis of factors affecting food security in rural and urban farming households of Benue State, Nigeria*.International journal of food and Agricultural economics 4(1) pp. 55-68.

Adamu, I.G., Mada, D.A. and Kabri, H.U. (2014).*Comparison of yam storage techniques to reduce postharvest losses with regard to effective storage structures in Ganye Local Government, Adamawa State, Nigeria*. IOSR Journal of Engineering. 4(8), pp 26-31.

Ahmed, R. and Rustagi, N. (1987).Marketing and price incentives in Africa and Asian countries. In Elz, D. (ed), Agricultural Marketing Strategy and Pricing Policy. Washington: International Bank for Reconstruction and Development.FAO (1998)

FAO (2000). The state of food and agriculture: Conflicts, agriculture and food security. Retrieved from www.FoodSecurityPortalon 15/01/2018.

FAO (2018). Save food: Global initiative on food loss and waste reduction. Key facts on food loss and waste you should know. Retrieved from www.fao.org on 28 February, 2018.

FAO (1998).Storage and processing of roots and tubers in the tropics. Edited by D.J.B Calverley, Retrieved from www.fao.orgon 20/12/2016.

Gernah, D.I., Ukeyima, M.T., Ikya, J.K., Ode, F.K. and Ogunbande, B.J. (2013).*Addressing food security challenges through agro-raw materials processing*. Agricultural Science Research Journal. 3(1), pp 6-13.

Ivanda, D.P., Igbokwe, E.M, Olatunji, O.M. (2015). *Assessment of food security situation of Tiv farming households in Nigeria*.Journal of Agricultural Extension.19(1).

Kiaya, V. (2014).Postharvest losses and strategies to reduce them. A technical paper published by ACF International.

Kitinoja, L. and Gorny, J.R. (1999). Postharvest technology for small-scale produce marketers: economic oppoturnities, quality and food safety. Univ. Calif. Postharvest Host.Series No.21.

Ministry of Fisheries, Crops and Livestock, New Guyana Marketing Corporation and National Agricultural Research Institute (2014). Yam: postharvest care and market preparation. Postharvest handling technical bulletin No.32.Retrieved from www.pdf.usaid.gov on 19/7/2017

Nwafor S.C., Wegh F.S., Ikwuba A.A., and Adegbola A.J. (2019). Effect of Marketing Extension Services on the Control of Post-harvest Losses of Root and Tuber Crop Producein Abia State, Nigeria. *Asian Journal of Agricultural Extension, Economics and Extension* 29(3) 1-12

Opera, L.U. (2003). Yams: postharvest operation INPHO postharvest compendium. Retrieved from www.fao.org on 20th January 2017.

Osunde, Z.D. (2008). *Minimizing postharvest losses in yam (dioscorea spp): treatments and techniques,* in Robertson, G.L. & Lupien, J.R. (eds). *Using food science and technology to improve nutrition and promote national development.*International Union of Food Science &Technology.

Phillips, D., Ogbonna, M., Etudaiye, H., Mignouna, D. and Siwoko, B. (2013).Yam improvement for income and food security in West Africa. Nigeria: Detailed yam value chain analysis. Retrieved from www.iita.org on 20 January, 2017

Sanginga, N. and IITA (2015).Root and tuber crops (cassava, yam, potato and sweet potato).Feeding Africa: an action plan for African agricultural transformation.Abdou Diouf International Conference Center, Daltar, Senegal.

Silas, D. (2018: January 18). Herdsmen burn ex-naval chief's farm, destroy crops worth over N200 million in Kwara. Retrieved from www.dailypost.ngon 25/01/2018.

Verter, N. and Becvarova, V. (2014).*Yam production as pillar of food security in Logo local government area of Benue state, Nigeria*.European Scientific Journal.10(31). Pp. 27-42.

Yam Farmers Association (2018).Logo, Ukum and Katsina Ala Branchs.Unpublished names of registered members of yam farmers association.

.