Impact of Yam Postharvest Activities on Standard of Living of Yam Farming Households in North-East Zone of Benue State, Nigeria

Solomon Arumun Agba[1], Idu Ode[2], Comfort Ugbem[2] and Solomon Chimela Nwafor[3*]

[1]*Department of Sociology, University of Mkar, Nigeria.*
[2]*Department of Sociology, Benue State University, Makurdi, Nigeria.*
[3]*Extension Services Unit, National Root Crops Research Institute, Umudike, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. Author SAA designed the study, wrote the protocol and wrote the first draft of the manuscript. Author SCN performed the statistical analysis, and managed the analyses of the study, Authors IO and CU managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: The aim of the study was to identify postharvest activities of yam farming households in North-East Zone of Benue State, Nigeria and to assess the impact of losses from the yam postharvest activities on standard of living of yam farming households in North-East Zone of Benue State, Nigeria.
Study Design: Survey research design was adopted for the study.
Place and Duration of Study: North-East Zone of Benue State, Nigeria.
Methodology: 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 from where a total sample size of two hundred and four (204) yam farming households were drawn from three local government areas of North-East Zone of Benue state using multi-stage cluster sampling technique.

Corresponding author: E-mail: Solomonnwafor8@gmail.com;

Results: Almost all the farmers 99% (202) store their yams and majority of the farmers are also involved in yam marketing. Majority of the famers 84% (172) always need to transport their yams. This could be in order to access distant markets which make for more gain. The few who do not need to transport their produce could be those who sale at farm gates. This could also be the reason why only a few 64% (130) majority take time to sort, grade and clean their produce. With the computed f-statistic value of 512.110 which was significantly higher than the tabulated f-value of 16.26 at 1% level of significance and 5.05 at 5% level of significance, therefore, the null hypothesis was rejected. This implies that, yam loss from yam postharvest activities noted above has a significant negative impact on the standard of living of yam farming households in the study area by reducing their household income (99%), affecting their access to health care services (89%), access to education (64%), access to good housing (84%) and access to sufficient quality food (98%).

Conclusion: The study thus concludes that, yam loss during postharvest activities such as: yam handling, yam storage, yam transportation, yam sorting / grading / cleaning and yam marketing has significant negative impact on the standard of living of yam farming households in the study area, by reducing their household income, affecting their access to health care services, access to education, access to good housing and access to sufficient quality food. The study recommends communication of knowledge on modern yam storage methods to yam farmers in the study area by agricultural extension agents and building of yam processing factories in the study area so as to add economic value to yam and consequently improve the standard of living of yam farming households in the study area.

1. INTRODUCTION

The importance of yam to Nigerian people and yam farming households in particular is evident in the fact of its integration into the social, economic, cultural and religious aspects of their lives [1;2].

Economically, yam is a cash crop, which plays an important role in the livelihood of about 60 million people in West Africa, including Nigeria and Benue State, where it is predominantly cultivated [3;4]. This is because, over 60% of farming households in Nigeria and Benue State in particular, engage in yam cultivation, not only as a means of household food supply, but also as a primary source of income [5;6]. Therefore, it can be seen that many yam farming households engage in yam cultivation, not only as means of household food supply, but also as a source of income generation through marketing surplus ware and seed yams.

Yam cultivation seems to be profitable for yam farming households, despite high cost of yam production and price fluctuations in the markets. The average profit per seed yam, after harvest and storage stands at over US13,000 dollars per hectare harvested and over 60% of Nigerians households grow yams as a primary source of income [5;6]. It has been found that, in West Africa, yam is a superior economic good [4] and it is increasingly becoming a major source of

foreign exchange in the region as an export crop [3]. The foregoing clearly attests to the importance of yam to yam farming households, not only as a food crop, which facilitate direct availability of food to households, but also as a source of income generation which can improve the socio-economic conditions of living of the households.

Socio-culturally, yam plays a significant role in social rite of passage and thanksgiving [3]. It is also used in other traditional rituals such as: marriage ceremonies and annual festivals [4] like the 'Orureshi' (New yam festival) among the Idoma and the Igede-Agba New Yam Festival among the Igede people both in Benue State. Virtually, all the ceremonial activities during the Igede Agba new yam festival celebration such as: eating of pounded yam in group, cultural music, dancing, exchange of gifts and especially holding household meetings to resolve interpersonal/group grievances and making plans for next planting seasons [7], can translate into the continuity of yam production, income generation from yam and continuous availability of food among yam farming households. The importance of yam outlined above gives it prominence over other food crops in West Africa, including Nigeria and Benue State [3;5].

However, there is a notable high level of postharvest losses of yams in Nigeria, like 20% to 67% [8] or 40% to 50% [4;9]. Among all the

factors found to be responsible for losses of yams poor storage methods seem to be the predominant reason for postharvest losses of yams in Nigeria.For instance, [10] observed that postharvest losses of yam which result from poor storage constitute about 20-30%. [11] has corroborated that, on the whole, storage practices remain rudimentary and causes about 30% of both physical and economic losses of yam value chain actors, especially yam farmers who engage in yam business as a primary source of income generation.

When losses of yam occur in yam farming households, there can be serious implications for the standard of living of the households. In terms of the impact of postharvest losses of yam on the standard of living of yam farming households, [12;13;2] have all observed that postharvest losses of yam reduces the profit margin of yam farming households, especially for those who engage in yam farming as a primary source of income and livelihood. Any loss thus, directly affects their income and invariably economic capacity which could have enabled them to improve their standard of living by attending to their domestic needs such as: access to health care services, access to good housing, access to education.

However, Benue is acclaimed "the food basket of Nigeria" and the largest producer of yam in Nigeria and West Africa with the largest yam markets located in North-East Zone of Benue [11], 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. Given this prospect, the standard of living of yam farming households in Benue North-East Zone should supposedly, not be negatively impacted by postharvest losses of yams. It is against this background that this study is initiated to assess the impact of postharvest losses of yam on the standard of living of yam farming households in North-East Zone of Benue State, Nigeria.

This study will contribute to knowledge by adding to the literature on postharvest losses of yam and its implication for standard of living of yam farming households, which will invariably serve as a source of data by which future researchers, especially in the area of postharvest losses will be aided for effective research.

1.1 Objectives of the Study

The objectives of the study were to identify postharvest activities of yam farming households in North-East Zone of Benue State, Nigeria, and to assess the impact of yam postharvest activities on standard of living of yam farming households in North-East Zone of Benue State, Nigeria.

1.2 Hypothesis of the Study

Yam loss in postharvest activities has no significant impact on standard of living of yam farmers in North-East Zone of Benue State, Nigeria.

2. 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.

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 [14]. Using a multi-stage cluster sampling and purposive sampling techniques, four (4) council wards were randomly selected from each of the three selected local government areas, then seventeen (17) respondents were selected from each of the council wards with the aid of the lottery method. 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. For questionnaire development, a table specifying yam postharvest

activities was drawn with instruction for respondents, indicating their freedom for multiple choice responses. Likewise, a table specifying the ways by which losses from yam postharvest activities affect the standard of living of respondents' households was drawn, with reference to the Human Development Index indices of standard of living, with indication of respondents' freedom for multiple choice responses. The validity and reliability of the questionnaire was tested by experts in the field of Sociology in the Department of Sociology from Benue State University, Makurdi. Descriptive statistics such as: frequency count and percentages were used to achieve the objectives of the study, while inferential statistic; multiple regression analysis was used to test the hypothesis of the study.

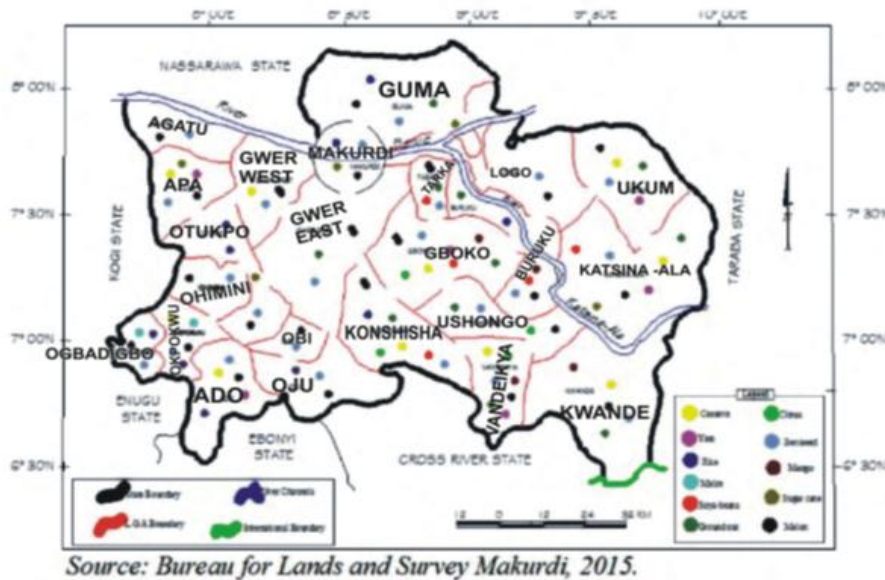**Fig. 1. Map of Benue State showing distribution of local government areas by zones**

Fig. 2. Crop production map of Benue State

Model Specification

For hypothesis, we specify multiple regression model thus;
Mathematical approach of the model;

$$Y = F(X_1, X_2 X_3, X_4, X_5)\ldots\ldots\ldots 1$$

Econometric approach of the model;

Linear model;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ei \ldots\ldots 2$$

Exponential model;

$$LogY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ei \ldots\ldots 3$$

Semi-log model;

$$Y = \beta_0 + log\,\beta_1 X_1 + log\beta_2 X_2 + log\beta_3 X_3 + log\beta_4 X_4 + log\beta_5 X_5 + ei \ldots\ldots 4$$

Double log;

$$LogY = \beta_0 + log\beta_1 X_1 + log\beta_2 X_2 + log\beta_3 X_3 + log\beta_4 X_4 + log\beta_5 X_5 + ei \ldots\ldots 5$$

Where;

Y = Standard of Living; X_1 = Handling pattern of yam; X_2 = Yam Storage facilities/method; X_3 = Yam transportation facility; X_4 = Sorting, grading and cleaning of yam; X_5 = Marketing of yam; $b_1 - b_5$ = parameters estimate; b_0 = intercept; ei = error term.

3. RESULTS AND DISCUSSION

3.1 Postharvest Activities of Yam farming Households in North-East Zone of Benue State

Table 1. Postharvest activities of yam farming households

Variables	Frequency	Percentage
Handling/Curing	182	89
Storage	202	99
Transportation	172	84
Yam Sorting, Grading and Cleaning	130	64
Marketing of Yams	200	98
Processing	-	-

Source: Field Survey, 2018; NB: Multiple response table

The result in Table 1 identified the post-harvest activities farmers carry out after harvesting their yam. These activities include sorting, grading, and cleaning, curing, storage, transportation, and marketing. These are the major postharvest activities carried out in the business of yam cultivation. Almost all the farmers 99% (202) store their yams and majority 98% (200) of the farmers are also involved in yam marketing. Majority of the famers 84% (172) always need to transport their yams. This could be in order to access distant markets which make for more gain. The few who do not need to transport their produce could be those who sale at farm gates. This could also be the reason why only a few 64% (130) majority take time to sort, grade and clean their produce. This finding is consistent with that of [15] who established that storage is a crucial stage in the yam postharvest system and many yam farmers involve in it because, for yams to be available to households throughout the year, harvested yam tubers must be stored for about six to eight months before new yams are harvested. Furthermore, the findings supports that of [16] many yam farmers are also directly involve in yam marketing at the market with complain of losses that reduces their profit margin and adversely affect their standard of living. The lack of yam processing in the study area corroborates the findings of [17] from her study on storage and processing of roots and tubers in the tropics, that the widespread use of modern yam storage and processing methods in many yam producing areas is not yet feasible

because of the high capital cost and lack of technical support structure.

3.2 Impact of Losses from Yam Postharvest Activities on Standard of Living of Yam Farming Households in North-East Zone of Benue State

The result in Table 2 shows the impact of losses from postharvest activities in yam on standard of living of yam farming households in the study area. The result indicates that, yam losses from postharvest activities affect the household income of nearly all 99% (202) of the yam farming households in the study area. There is no gain saying that, income is a primary determinant of standard of living of households because it determines their purchasing power and/or access to domestic necessities such as: quality food and good health care service. Findings from the focused group discussion also corroborates this finding, as virtually all participants in both Ukum and Logo discussion groups responded in the affirmative that postharvest losses in yam has reduced their profit margin and thus reduce their household income which consequently becomes insufficient to attend to their domestic financial needs. This finding is consistent with that of [18] that, there is a significant positive relationship between income and standard of living.

Table 2. Impact of yam postharvest activities on standard of living of yam farming households

Variables	Frequency	Percentage
Affect access to good health care services	182	89
Reduces profit margin and household income	202	99
Affect access to good housing/residence	172	84
Affect access to education	130	64
Affect access to quality food	200	98

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

Furthermore, the table also reveals that postharvest losses of yams also reduce 98% (200) of yam farming households' access to quality food. The words of a focused group discussant from Uyam ward in Ukum Local Government Area gives a clear picture of the scenario of the impact when he submitted that:

In my own house, we cultivate yam mainly for sell, although our yam farm is not very big, but we have many needs. So, I can tell you that, whenever we have losses after harvest, it affects our income and because we usually sell majority of our yams and also buy other food, it becomes a problem to buy the kind of food that will give us a balanced diet as we want in the house.

Table 2 also shows that postharvest losses of yams have affected yam farmers' households' access to education. 64% (130) of the farmers noted that postharvest losses in yams has a negative impact on their standard of living by the difficulty they encounter in attempt to secure formal education. That such difficulty is usually in terms of difficulty to attend to educational financial requirements such as: payment of school fees. Just as a discussant from Mbayam ward in Logo Local Government Area averred that:

I also farm yam mainly for commercial purpose because of the money that I can make in it, to help me do many things like build a good house and go to good hospital for treatment. So, any loss of yams really means reduction of money to me and because I want to give all my children good education, I begin to have some problem with payment of school fees.

The comment by a discussant noted above, also corroborates the result on Table 2 which reveals that postharvest losses of yam negatively affects the standard of living of many yam farming households in the study area by affecting their access to good health care services (89%: 182) and access to good housing or place of residence (84%: 172). Some of the discussants in Ukum Local Government Area averred that, there are no tertiary medical centers such as: teaching hospitals and federal medical centers in the study area where top quality health care is offered. That, given this situation, many serious cases of ill-health has to be taken out of the study area, which has financial implications and it becomes difficult in the face of financial difficulty, which is on account of the losses. This finding corroborate the finding of [19] who established from their study on factors affecting adoption of yam storage technologies in Edo State, that postharvest losses of yams reduces the profit margin of yam farming households and invariably have negative impact on their income and economic capacity to ensure a good standard of living.

3.3 Test of Hypothesis

The result of the ordinary least square multiple regression analysis used to test the hypothesis that, yam lost during postharvest activities has no significant impact on standard of living of yam farming households in North-East Zone of Benue State, Nigeria is presented on Table 3.

Based on the magnitude of the coefficient of multiple determinations (R^2), the number of significant variables, the signs of the regression coefficient as they conform to a priori expectations and the significance of the entire model as indicated by the F-statistic, the Double-log model was selected as the lead model. The value of the coefficient of multiple determinations (R^2) was 0.928, which implies that about 92.8% of the standard of living of yam farming households in North-East Zone of Benue State is explained by the explanatory variables included in the model. The F-statistic of the lead equation (512.110) is significant at 1%, which implies that the model was well specified. Thus, handling of yams after harvest, yam storage method, yam transportation method, method of sorting, grading and cleaning of yam, and marketing of yams were observed to be the significant postharvest activities by which losses of yam has significant impact on standard of living of yam farming households in North-East Zone of Benue State.

The coefficient of postharvest handling of yams (-10.659) was negatively related with the standard of living of yam farming households in the study area at 1% level of significance. This implies that increase in the manner in which yam is handled after harvest in the study area will result into more losses of yams and thus lead to decrease in the standard of living of yam farming households in North-East Zone of Benue State.

The coefficient of yams storage method (-5.827) was negatively related with the standard of living of yam farming households in the study area at 1% level of significance. This implies an inverse relationship of the manner of yam storage with standard of living of yam farming households. Thus, an increase in the manner which yam is currently stored in the study area will lead to a decrease in the standard of living of yam farming households in the study area.

The coefficient of yam transportation (-12.890) was negative and statistically significant to standard of living at 1% level of significance. This implies an inverse relationship of means of yam transportation with standard of living of yam farming households in the study area. This means that, if transportation services and facilities are not improved in the study area, then standard of living of farming households will continue to fall.

The coefficient of sorting, grading and cleaning of yams (-2.159) was also negative and statistically significant of standard of living at 5% level of significance. This indicates an inverse relationship between yam sorting, grading and cleaning and standard of living of yam farming households in the study area. By implication, increase in the manner by which these activities are done, which results into losses, will negatively affect and/or lead to a decrease in the standard of living of yam farming households in the study area.

The coefficient of yam marketing (-9.827) was negatively related with the standard of living of yam farming households in the study area at 1% level of significance. This implies an inverse relationship between marketing of yams and standard of living of yam farming households in the study area. This means that, increase in the manner in which yam is marketed due to the circumstances surrounding yam marketing in the study area, which results into losses, will negatively affect and / or lead to decrease in the standard of living of yam farming households in North-East Zone of Benue State. It should be noted that farmers struggle to sale their produce. This could be because all of the farmers harvest at the same time which leads to glut. When this happens, farmers tend to sell at farm gate prices and at a drastically reduced price which may be unfavorable to them. Thus if these factors keep repeating, it will affect the living standard of the farming household negatively which could be in terms of reduced income, limited access to health care, food availability at home among others.

Given that the computed f-statistic value of 512.110 was significantly higher than the tabulated f-value of 16.26 at 1% level of significance and 5.05 at 5% level of significance, we therefore, reject the null hypothesis that "yam loss during postharvest activities has no significant impact on standard of living of yam farming households in North-East Zone of Benue State", and accept the alternative hypothesis that "yam loss during postharvest activities has significant impact on standard of living of yam farming households in North-East Zone of Benue State". This finding is consistent with that of [18]

Table 3. Result of the multiple regression analysis of the impact of yam loss during postharvest activities on standard of living of yam farming households in North-East Zone of Benue State

Variables	Linear	Exponential	Semi-log	Double-log+
Constant	0.216	-0.023	0.653	0.041
	(1.585)	(-1.184)	(4.489)***	(2.424)***
Handling of yams after harvest	0.566	0.067	5.057	0.606
	(10.093)***	(8.486)***	(10.473)***	(10.659)***
Yam Storage methods	0.268	0.062	0.932	0.314
	(4.328)***	(7.095)***	(2.034)**	(5.827)***
Yam Transportation facility	0.660	0.105	4.064	0.660
	(12.681)***	(14.325)***	(9.346)***	(12.890)***
Sorting, Grading and Cleaning	-0.160	-0.027	-0.624	-0.129
	(-2.655)*	(-3.153)***	(-1.224)	(-2.159)**
Marketing of Yams	-0.354	-0.056	-3.227	-0.492
	(-5.732)***	(-6.489)***	(-7.586)***	(-9.827)***
R^2	0.867	0.885	0.881	0.928
Adj. R^2	0.864	0.882	0.878	0.926
F-ratio	(258.520)***	(305.656)***	(292.736)***	(512.110)***

*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*

who established that, losses from postharvest activities have a significant negative impact on the standard of living of farming households.

4. CONCLUSION / RECOMMENDATIONS

The study thus concludes that, yam loss during postharvest activities such as: yam handling, yam storage, yam transportation, yam sorting / grading / cleaning and yam marketing has significant impact on the standard of living of yam farming households in the study area which is in terms of reducing their household income, affecting their access to health care services, access to education, access to good housing and access to sufficient quality food.

The study therefore, recommended that, agricultural extension agents should communicate knowledge on modern yam storage methods to yam farmers in the study area. The Government and private investors should take a business opportunity by building yam flour processing factory(s) in the study area, which will provide a ready yam market that will reduce postharvest losses of yams and increase the economic value of yams, which will invariably raise the profit margin of yam farmers and consequently translate into improvement in the standard of living of their households.

Due to lack of research funding which constituted the main limitation on the scope of this study, the study, therefore, suggests an assessment of the level of impact which losses from yam postharvest activities has on the standard of living of yam farming households in the study area, as a recommendation for further study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Okigbo RN, Ogbonnaya UO. Antifungal effects of two tropical plant extract (*Ocimum gratissimum* and *Aframomum melegueta*) on postharvest yam rot. African Journal of Biotechnology. 2006;5(9):727-731.
2. Verter N, Becvarova V. An analysis of yam production in Nigeria. Acta Universitatis Agriculturae et. Silviculturae mendalianae Brunensis. 2015;63(2):695-665.
3. Mignouna DB, Akinola AA, Suleman I, Nweke F, Abdoulaye T. Yam: A cash crop in West Africa. YIIFSWA working paper series No. 3; 2014.
   Available:www.iita.org
   (Accessed:22 December, 2016)
4. Sanginga N, IITA. 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; 2015.
5. Izekor OB, Olumese MI. Determinants of yam production and profitability in Edo

state, Nigeria. African Journal of General Agriculture. 2010;6(4):205-221.

6. International Institute for Tropical Agriculture (IITA). Healthy yam seed production. IITA Publications; 2013. Available:www.iita.org.on 5/10/2017.

7. Egbodo B. Igede Agba new yam festival: An emblem of identity renewal in Igede nation; 2016.
Available: www.benuenews.com
(Accessed: 27 January, 2017)

8. Gernah DI, Ukeyima MT, Ikya JK, Ode FK, Ogunbande BJ. Addressing food security challenges through agro-raw materials processing. Agricultural Science Research Journal. 2013;3(1): 6-13.

9. Food and Agricultural Organization. Save food: Global initiative on food loss and waste reduction. Key facts on food loss and waste you should know; 2018.
Avaialble:www.fao.org

10. Adamu IG, Mada DA, Kabri HU. 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. 2014;4(8): 26-31.

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

12. Okoedo-Okojie DU, Onemolease EA. Factors affecting the adoption of yam storage technologies in the Northern ecological zone of Edo state, Nigeria. Journal of Human Ecology. 2009; 27(2):155-160.

13. Akangbe JA, Oloruntoba OO, Ayanda IF, Komolafe SE. An analysis of yam storage strategy to promote food security in Asa Local Government Area of Kwara State, Nigeria. Ethiopian Journal of Environmental Studies and Management. 2012;5(4):550-558.

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

15. Osunde ZD. Minimizing postharvest losses in yam (dioscorea spp): Treatments and techniques, in Robertson GL, Lupien JR. (eds). Using food science and technology to improve nutrition and promote national development. International Union of Food Science and Technology; 2008.

16. Dapaah PK. Assesssment of postharvest losses of yam production in the Krachi-East district of the Volta region of Ghana; 2014.
Available:www.dspace.knust.edu.gh/handle

17. FAO. Storage and processing of roots and tubers in the tropics. Edited by Calverley DJB; 1998.
Available:www.fao.org
(Accessed:20/12/2016)

18. Halam K, Dywili M, Nwokolo EE. The role of education, income in determining standard of living and food security among the residents of Mhlontlo Local Municipality Eastern Cape, South Africa. Journal of Human Ecology. 2017;60(1):18-28.

19. Okoedo-Okojie DU, Onemolease EA. Factors affecting the adoption of yam storage technologies in the Northern ecological zone of Edo State, Nigeria. Journal of Human Ecology. 2009;27(2):155-160.