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Adoption of Yam Storage Techniques and Food Security Status of Rural Farmers in Enugu State, Nigeria

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ABSTRACT
*The study examined the effect of yam storage techniques adoption on food security of rural farmers in Enugu State, Nigeria. Multistage random sampling technique was adopted in selecting 120 yam farmers in Enugu State. The results indicate that majority of the respondents (60.0%) were males with mean age of the farmers at 48.8. Almost all (91.3%) the respondents were married. The mean experience was approximately 19 years. Majority (98.3%) of the respondents in the study acquired one form of formal education or the other. More than half of them indicated that they belonged to one association or the other. Preponderance of the rural farmers (81.7%) encountered extension visits. The result shows that Yam barn was the major storage technique popularly known and adopted by most of the farmers in Enugu State. The study showed that majority of the rural households were food secure (60%) as they were able to meet the recommended calorie intake per capita per day. Correlation analysis (0.836**; P = 0.000 < 0.05) showed that an increase in level of adoption of yam storage techniques led to increase in food security. Furthermore "Ignorance of existence" ($X\bar{}$ = 4.10), "Do not understand how to use it (X= 4.02); High cost of methods (3.25) and Non – available of technology had a mean of ($X\bar{}$=3.01). The study therefore recommended that yam storage techniques should be made available to the farmers in the study.*

Keywords: Yam Storage Techniques, Adoption, Food Security, Rural Farmers, Enugu State.

INTRODUCTION

Attainment of food self-sufficiency is one of the prominent developmental agenda facing most nations of Sub-Saharan Africa (SSA) (Saka et al., 2011). Nigeria, by virtue of its prominent position as the most populous nation in the region, is in no way facing lesser challenges of reducing dependence on food import through improvement in food self-sufficiency ratio which, in turn, is pivoted on increased domestic food production (Saka et al., 2011). Iheke and Ihuoma (2015) noted that developing countries, especially those in Africa have the highest urbanization rates in the world. Food security according to Food and agriculture Organization, (FAO, 2016) sense consists of having at all times an adequate level of basic products to meet increasing consumption demand and mitigate fluctuations in output and prices. Food security is widely seen as access by all people at all times to have enough food for an active life, while food insecurity is the inability of a household or individuals to meet the required consumption levels in the face of fluctuating production, price and income. At the national level, food security exists when all people at all times

have the physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life, while at the household level, food security implies physical and economic access to food that is adequate in terms of quantity, safety and cultural accessibility, to meet each person's need (Idrisa, 2006).

Yam storage structures come in different shapes and sizes depending on the ability of the farmer, locality and cultural practices. The construction materials are usually wood, ropes, palm fronds, guinea corn stalks, and mud (FAO, 2004; Umogbai and Satimehin, 2004). The most common problems faced by farmers are post-harvest losses. Wastage occurs because the apparent surplus during the harvest season cannot be consumed within a short period. However, few months after the harvest, there is always a diminishing availability of yam produce. Therefore, it becomes imperative that the existing yam tubers are stored in structures for later use (Umogbai, 2013).

There are several low-cost storage methods and structures for yam tubers; the most common of them include Yam barn, covered table, elevated pole, yam house, heap on the floor, underground structure, open sided shelves, coating with territorial soil, cold storage and gamma radiation (Falola *et al*., (2017). Umogbai (2013) also reported that there are well ventilated weather-proof, insect and rodent proof strong shelters for storage of yam tubers. There is therefore the need to promote less expensive, improved storage structures using local materials such as Underground structure for smallholder yam farmers. This approach will ensure an all-year-round availability of yams, which is critical in achieving sustainable food security in the country.

Farmers' usage of yam storage technologies would lead to reduction in food losses, improved income and enhance food security (Okoedo-Okojie & Onemolease, 2009). To minimize post-harvest losses, improved methods of storage such as open sided shelves and Underground structure have therefore been developed. However, the poor economic status of most Nigerian farmers has inhibited the adoption and usage of most agricultural technologies (Alimi & Zango, 2016).

Farmers would usually run at a loss at the end of the farming season, making this situation a great disincentive to yam farmers in Nigeria and the sub-Saharan Africa at large. This without doubt, would greatly affect the country's food security as far as yam production is concerned. Based on the above stated problem the study specifically:

i ascertained the yam storage techniques presently available in the area;
ii assessed the farmers' awareness and adoption of improved yam storage methods such as open sided shelves and Underground structure
iii determine the level of adoption of yam storage techniques by farmers in the study area
iv determine the food security status of farmers in the study area
v determine the effect of yam storage techniques on household food security;
vi identify the factors affecting the adoption of these improved storage methods.

METHODOLOGY

The study was carried out in Enugu State, Nigeria. Enugu State was created in 1991. The State comprises seventeen (17) LGAs. The State lies between latitudes 5° 56′ and 7° 05′N of equator and longitudes 6° 53′ E and 7° 55′E of Greenwich meridian. The State shares boarders with Abia State to the south, Ebonyi State to the East, Benue State to the North east, Kogi State to the Northwest and Anambra State to the west (ENADEP, 2009). Multi-stage sampling technique was adopted for this study. At the first stage, three agricultural zones out of the six were randomly selected; in the second stage, one local government area (LGA) was randomly selected from each of the selected agricultural zone. In the third stage, two communities were randomly selected from each of the LGAs giving a sample of 6 communities. In the fourth stage 2 villages were randomly selected from each community; giving a sample of 12 villages. In the last stage, list of yam farmers in the selected 12 villages were compiled with the help of enumerators who are natives of the villages, from this list 10 yam farmers were selected from each village, giving a sample size of 120 yam farmers for the study. Data for this study were collected from primary sources.

Model specification

The level of adoption of yam storage techniques was realized using Index ranking. Responses for this was rated by using three-point scale with the scoring order of 3, 2 and 1 as often, moderately, and seldom respectively. A weighted average index (WAI) of 2.0 was hen be estimated using the formula:

$$\text{WAI} = \frac{F3W3 + F2W2 + F1W1}{F3 + F2 + F1} \quad (1)$$

$$\text{WAI} = \frac{\sum \text{FiWi}}{\sum \text{Fi}} = \text{WAI} = \frac{\text{WI}}{\sum \text{Fi}} \quad (2)$$

Where: *F* = frequency; *Wi* = weight of each scale; *i* = individual scale; *WI* = weighted index (Ndamani and Watanabe, 2016)

Food Security Index

$$F_i = \frac{\text{Per capita monthly food expenditure for the ith household}}{\text{2/3 means per capita monthly food expenditure of all households}} \quad (3)$$

Where Fi = Food security index. When Fi ≥ 1 it implies that the i^{th} yam farming household is food secure, but when Fi < 1, it implies that the i^{th} yam household is food insecure.

Correlation Matrix

The correlation model for effect of yam storage techniques on food security status of the farmers in the study area is given as:

$$r_i = \frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2) - (n\sum y^2 - (\sum y)^2)}} \quad (4)$$

Y = Adoption of yam storage techniques
X = food security status (food secured= 0; non-food secured = 1)
∑ = summation sign.
r_i = correlation coefficient in period.
n = number of respondents to be studied

RESULTS AND DISCUSSION

Socioeconomics characteristics of the farmers

The socioeconomics characteristics of the yam farmer is summarized and presented in Table 1. Descriptive statistics like frequencies table, percentages and means were used to achieve this objective.

Sex of the rural yam farmers showed that majority of the respondents (60.0%) were males while 40. % were females. This is probably because yam production is energy demanding thus female farmers prefer to go into the production of other crops. This result is in line with the finding of Falola et al., (2017) who noted that 73.9% of yam farmers. Also Suleiman (2014) noted that 85% of yam farmers were males. This shows that males dominated farming activities in the area. However, this result proves positive since women in African countries form big portion of the population undertaken farming activities, though they face socially conditioned inequalities in the access, use and control of household resources.

The result in the table 1 showed that the mean age of the farmers was 48.8. This means that the farmers' are ageing and the implication is that farming and processing activities in the rural areas is dominated by older farmers because of the outmigration of youths to urban centers in search of white-collar jobs.

Table 1: Socio-economic Characteristics of the Rural farmers

Variables	Frequency	Percentage (%)
Sex		
Female	48	40.0
Male	72	62.0
Total	**120**	**100.0**
Age (years)		
30 – 39	16	13.3
40 – 49	50	41.7
50 – 59	40	33.3
60 – 69	14	11.7
Mean	**49**	
Total	**120**	**100**
Marital status		
Married	109.5	91.3
Single	2.5	2.1
Divorced	6.5	5.4
Widow	1.5	1.3
Total	**120**	**100.0**
Experience		
1 – 10	24	20.0
11 – 20	46	38.3
21 – 30	34	28.3
31 – 40	16	13.3
Total	120	**100**
Mean	19	**1.7**
Education		
No formal education	2	1.25
Primary	65	54.58
Secondary	30	25.00
Tertiary	23	19.17
Total	**120**	**100.0**
Association		
No	44.5	37.1
Yes	75.5	62.9
Total	**120**	**100.0**
Extension services		
No	22	18.3
Yes	98	81.7
Total	**120**	**100.0**

Source: Field survey (2019)

Furthermore, the study showed that 91.3% of the respondents were married, 2.1% were single while 5.4% and 1.3% were divorced and widows respectively. This is typical of Nigeria rural setting because family members often serve as a source of additional labor together with cultural value attached to marriage, implying that household labour might complement farming activities. Marital status can influence the role and responsibilities as well as occupational lives of members and their family

From table 1, the survey showed that the respondents (20.0%) had spent 1 – 10 years, 38.3% had spent 11- 20 years while 28.3% and 13.3 had spent 21 – 30 and 41 – 50 years in farming respectively. The mean experience was approximately 19 years. This showed that rural farmers in the study area had considerable experience in farming. The number of years a farmer spends in farming give an indication of the practical knowledge he has acquired. The implication of this is that they are equipped to overcome their farming challenges to a considerable extent.

Majority (98.3%) of the respondents in the study acquired one form of formal education or the other. The result implies that the farmers are highly literate having acquired one level of education or the other. This means that they can be easily convinced to accept better practices of their farming operations. A greater deal of change has occurred within the rural communities in recent times due to the introduction of education. Their high literacy level is an asset as the farmers would be exposed to many information sources, embrace innovations and analyze farm situations objectively. Undoubtedly, the high level of literacy predisposes some level of managerial ability in the farm business (Alimi., and Zango, 2016).

From the result, a dominant number of the farmers indicated membership of association. Specifically, 62.9 percent indicated that they belong to one association or the other. However, on the contrary, 37.1 percent indicated that they do not belong to any association. Membership of association satisfies the social needs of farmers in additions to serving as an avenue for access to information on agricultural technology. Farmers by virtue of their membership discern the obvious advantages of agricultural technology as well as clarify their misconception of technology and the adoption. However, the farmers that do not belong to association may have been ignorant of the obvious gains through membership. This however calls for conceited extension campaigns for farmers member of co-operative society and combined.

Preponderance of the rural farmers (81.7%) encounter extension visitors while 18.3% of the sampled population never had extension contact. This suggests that greater numbers of the sampled population come across extension visitors. Saka et al (2011) reported that better education through improve extension service would lead to improve knowledge and improves farm technologies, farm tools etc. which has strong influence on increase productivity.

Yam storage techniques available

Distribution of the respondent based on yam storage techniques presently available in Enugu State is presented in Table 2.

Table 2: Yam storage techniques available

Yam storage Techniques	Frequency*	Percentage	Ranking
Yam barn	39	32.5	1st
Covered table	26	21.6	3rd
Elevated pole	24	20.0	4th
Yam house	21	17.5	5th
Heap on the floor	11	9.2	7th
Underground structure	34	28.3	2nd
Open sided shelves	18	15.0	6th
Coating with territorial soil	7	5.8	8th

Source: Field survey (2019). *Multiple responses recorded.

Distribution of the respondent based on yam storage techniques presently available in Enugu State revealed that yam barn was the major storage techniques that was popularly known to most of the farmers in Enugu State. This is followed by Underground structure and Covered table which ranked 2nd and 3rd in the table above. Other techniques This finding is in line to those of Suleiman (2014), Okoedo-Okojie and Onemolease (2009), whose studies revealed that yam barn ranked first. It is worthy to note, however, that none of the farmers was aware of cold storage and Gama radiation storage techniques, which are modern and improved.

Table 3: Farmers' adoption of improved yam storage methods

Yam storage Techniques	Frequency	Percentage	Ranking
Yam barn	33	27.50	1st
Covered table	19	15.83	3rd
Elevated pole	21	17.50	2nd
Yam house	15	12.50	5th
Heap on the floor	4	3.33	7th
Underground structure	16	13.33	4th
Open sided shelves	11	9.17	6th
Coating with territorial soil	1	6.00	8th

Source: Field survey (2019). *Multiple responses recorded.

Distribution of respondent based on farmers' adoption of improved yam storage methods in Enugu State is presented and summarized in Table 3, the table revealed that yam barn was the major storage techniques adopted by farmers in Enugu State. This is followed by Elevated pole. Other techniques adopted include covered table, yam house, heap on the floor, underground structure, open sided shelves and coating with territorial soil.

Table 4: Level of adoption yam storage methods

Yam storage Techniques	Often	Moderately	Seldom	Total	Mean	Remark
Yam barn	73	31	16	297	2.48	Accepted
Covered table	40	43	37	243	2.03	Accepted
Elevated pole	49	36	35	254	2.12	Accepted
Yam house	49	36	35	254	2.12	Accepted
Heap on the floor	52	36	32	260	2.17	Accepted
Underground structure	37	49	34	243	2.03	Accepted
Open sided shelves	47	54	19	268	2.23	Accepted
Coating with territorial soil	33	35	62	231	1.78	Rejected
Grand mean					**2.12**	**Accepted**

Source: Field Survey, 2019

From the result, eights yam storage techniques were designed in the questionnaire to ascertain the level of adoption of yam storage techniques by farmers in the study area. From the result seven (7) of the variables in the table were accepted by the mean range used for decision which is 2.0 and above. Yam barn has on the average the highest mean ($\overline{X}$= 2.48) i.e. the respondents indicated strong agreement to the statement; this was followed by "Open sided shelves" has mean of ($\overline{X}$= 2.23); this was followed by "Heap on the floor" ($\overline{X}$=2.17). other are shown on the table. Also from the table one items were rejected since is less than 2.0, which was Coating with termitarial soil". Furthermore, the clustered mean was 2.12 which was accepted, this therefore implies that there is high level of level of adoption of yam storage techniques by farmers in the study area

Table 5: Mean per capita monthly food expenditure

Items	Mean value	Percentage share
Cereals (maize, rice, sorghum, wheat, bread)	21485	23.27
Tubers (sweet potatoes, cassava)	16641	18.02
Pulses (beans, peas, groundnuts)	10471	11.34
Fruits & vegetables	7163	7.76
Fish/Meat/Eggs/poultry	2151.75	2.33
Oil, fat, butter	4643	5.03
Milk, cheese, yogurt	6589	7.14
Sugar/Salt	2163.38	2.34
Tea/Coffee	7662.25	8.30
Other meals/snacks consumed outside the home	13354	14.46
Total expenditure	92323.38	100.00
Mean	9232.338	23.27

Source: Field survey (2019)

The result shows the monthly consumption expenditure. The study also shows that the total and mean expenditure were ₦ 92323.38 and 9232.338 respectively. This implies that every individuals requires ₦ 92323 necessary to maintain a certain level of household living standard given some change in demographic circumstances (typically, the introduction of children) per month.

Table 6: Distribution of the respondents based on Food security status

Food Security status	Frequency	Percentage
Food secured	72	60.00
Food insecure	48	40.00
Total	***120***	***100.0***

Source: Field survey, 2019

From the result obtained in Table 6 above, the respondent was then classified into food secured and insured household. A food secure household is, therefore, that whose per capita monthly food expenditure is at least two-third of the mean per capita monthly food expenditure. On the other hand, a food insecure household is that whose per capita monthly food expenditure is less than two-third of the mean monthly per capita food expenditure. The study area could be regarded as food secure given the fact that majority of the rural households (60%) were able to meet the recommended calorie intake per capita per day. Only 40% of the households were food insecure and unable to meet the recommended daily per capita calorie requirements.

Table 7: Effect of yam storage techniques on household food security

		Adoption of yam storage techniques	Food security
Adoption of yam storage techniques	Pearson Correlation	1	0.836**
	Sig. (2-tailed)		0.000
	N	60	60
Food security	Pearson Correlation	0.836**	1
	Sig. (2-tailed)	0.000	
	N	60	60

Source: Field survey (2019). ** = Correlation is significant at the 0.01 level (2-tailed).

The estimation of the effect of yam storage techniques on household food security were summarized in Table 7 above. The Pearson correlation analysis between level of adoption/ food security was (0.836**). This signifies that level of adoption present about 83.6% of food security of the yam farmers. Therefore, there is a positive relationship between level of adoption and food security of the yam crop farmers. the implication is that the more farmers adopt these technologies, the more food secure they become.

Table 8: Distribution of respondent based on factors affecting the adoption storage methods

Factors	Mean	Std deviation	Rank	Remark
Ignorance of existence	4.10	1.13	1st	Accepted
Non – available of technology	3.01	0.94	4th	Accepted
High cost of methods	3.25	0.97	3rd	Accepted
Do not understand how to use it	4.02	1.01	2nd	Accepted
Clustered mean	**3.60**			**Accepted**

Source: Field Survey, 2019

Four (4) item were designed in the questionnaire to ascertain the constraints**, f**rom the result shown in Table 4.5 above all the variables in the table were accepted by the mean range used for decision which is 3.0 and above. "Ignorance of existence" has on the average the highest mean ($\bar{X}$= 4.10) and was accepted i.e. the respondents indicated strong agreement to the question statement; followed by "Do not understand how to use it (X= 4.02); this is followed High cost of methods (3.25) and

Non – available of technology have a mean of ($\overline{X}$=3.01). Furthermore, the clustered mean was 3.60 which was accepted, this therefore implies that all items listed above were affecting the adoption of these improved storage methods

CONCLUSION

Based on this finding it can be concluded that usage of yam techniques is low despite the losses due to the use of traditional techniques. Also Socio-economic characteristics such as; education, income, farm size, credit and cooperatives has significant influence on level of adoption of yam storage techniques by farmers in the study area and finally an increase in level of adoption of yam storage techniques leads to increase in food security

RECOMMENDATIONS

1. New yam storage techniques should be made available to the farmers in the study area at subsidized rates so as to encourage them to use such techniques.
2. Since cooperative was significant, therefore extension agency should encourage the formation and membership of cooperative societies (such as farmer association, credit unions savings and thrift) among farmers.
3. The extension agencies should have a re-orientation of their service delivery systems, where female clientele will be treated equally with their male counterparts. This will ensure more agricultural development and effective participation in agricultural innovation.

REFERENCES

Adisa R.S., Adefalu L.L., Olatinwo L.K., Balogun K.S., Ogunmadeko O.O. (2015): Determinants of Postharvest Losses of Yam among Yam Farmers in Ekiti State, Nigeria. *Bull. Inst. Trop. Agr.,* Kyushu univ. 38: 73-78

Alimi H.M., Zango M.I. (2016): The Influence of Socio-Economic Variables on Adoption Behaviour Towards Tadco Improved Rice Parboiling Technique Among Rice Parboilers in Kura Processing Areas Of Kano State, Nigeria. *Agrosearch***.** 16 (2): 51-60

F.A.O (2005): FAO Annual Report. Food and Agriculture Organisation Production Year Book. Food and Agricultural Organisation of the United Nations, Rome.

Falola A., Salami M. F, Bello A. A. & Olaoye T. A (2017) Effect of Yam Storage Techniques Usage On Farm Income in Kwara State, Nigeria. 6(2): 67-75

FAO (2004) 'Small-Scale Post-harvest handling Practices; Corporative Document Repository', *Nigerian Food Journal*, 22, p. 195.

Idrisa, Y.L., Gwary. M.M. and Shehu H. (2006): Determinants of Adoption of Cassava Farming Technologies in Mubi north Local Government Area of Adamawa State Nigeria. *Journal of Production Agriculture and Technology, 2(2)*: *26-36.*

Iheke, O.R and Ihuoma U., Effect of Urbanization on Agricultural Production in Abia State, *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs) Available online on:* http://ijasrt.iau-shoushtar.ac.ir

Okigbo, R.N. and Ogbonnaya, U.O. (2006) 'Antifungal effects of two tropical plant leaf extracts (*Ocimum gratissimum* and *Aframomum melegueta*) on postharvest yam (*Dioscorea* spp.) rot', *African Journal of Biotechnology*, 5(9) Academic Journals (Kenya)

Okoedo-Okojie, D.U. and Onemolease, E.A. (2009) 'Factors affecting the farmers' adoption of yam storage technologies in the Northern ecological zone of Edo State, Nigeria', *J. Hum. Ecol.*, 27(2), pp. 155–160.

Saka, J.O., Okoruwa,V.O., Oni,O.A. & Oyekale, A.S. (2011). The Structure and determinants of land-use intensity among food crop farmers in Southwestern Nigeria. *Journal of Agricultural Science,* 3(1), 194-205.

Suleiman, M. (2014). Profitability ant technical efficiency of yam production in Kiama Local Government Area of Kwara state, Nigeria: A Bachelor of Agriculture project, Department of Agricultural Economics and Farm Management, University of Ilorin, Ilorin, Kwara State

Umogbai, V.I. (2013) 'Design, Construction and Performance Evaluation of an Underground Storage Structure for Yam Tubers', *International Journal of Scientific and Research Publications*, 3(5), pp. 1–7.

Umogbai, V.I. and Satimehin, A.A. (2004) 'Development and performance evaluation of a modified storage structure for fresh fruits and vegetables', *Journal of Prospects in Science*, 7, pp. 17–21.