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Evaluation of Farmers' Knowledge on Post-Harvest Technologies of Yam in Kogi and Niger States, Nigeria

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ABSTRACT
This study evaluated farmers knowledge on post-harvest technologies of yam in Kogi and Niger States, Nigeria. Multi-stage sampling technique was employed in the selection of 340 respondents for the study. Data were collected from primary source using structured questionnaire complemented with interview schedule. Both descriptive and inferential statistics such as knowledge test and Kendall coefficient of concordance. The results of the analysis obtained shows 81.2% of respondents were male with mean age of 42.6 years, mean household size was 8.0 persons and mean farming experience of 27.4 years. The results of knowledge test revealed that 36.2% of respondents had medium knowledge on post-harvest technologies of yam according to pooled results while 34.7% had high knowledge on post-harvest technologies of yam. The problems faced in the post-harvest technologies of yam were quick deterioration of crops ($\bar{X} = 8.1$) and inadequate credit with mean value of ($\bar{X} = 8.40$). The study also revealed that majority of the respondents used manual method of sorting and grading of the yam tubers. Therefore, it is recommended that credit and fund should be made available to the farmers so that they could purchase post-harvest tools that are needed to enhance longevity of produce, farmers should be trained and sensitized on every aspects of post-harvest technologies of yam in order to ensure usage. Also, government should subsidized the cost of post-harvest materials and tools so that farmers' can access them at affordable prices.

Keyword: Evaluation, Farmers'-knowledge, Post-harvest, Technologies, Yam

INTRODUCTION

Post-harvest can be defined as the stage of crop production immediately after harvesting. It involves stages such as drying, shelling, cleaning, sorting and packing (Vellema, 2008). Post-harvest technologies on the other hand can be defined as an inter-disciplinary science and methods applied to agricultural products after harvesting for the purpose of preservation, conservation, quality control/enhancement, processing, packaging, storage, distribution, marketing, and utilization to meet the food and nutritional requirements of consumers in relation to their needs. The roles of post-harvest technology in agricultural production cannot be over-emphasis, post-harvest technology enhance agricultural production by reducing post-harvest losses to the barest minimum, improves nutrition, adds value to agricultural products by opening new marketing opportunities, generating new jobs and enhance other related economic sectors for viable growth. More so, agricultural sector has contributed immensely to the economic development of the country by absorbing more labour force engaged in full or part-time farming. The effect was witnessed in the aspect of increase in production of agricultural produce at household level thereby making food available for farming families and also promote better standard of living.

Tropical root and tuber crops such as cassava, yam, and cocoyam are important household food security and income generating crops in many African countries (AMCOST 2006). Lack of adequate post-harvest handling in yam has led to post-harvest farm losses, this is because newly harvested yam are prone to diseases infections after some period of time. Also, in developing countries lack of appropriate post-harvest technologies has resulted to 20-30% losses, particularly this occurs as a result of post-harvest pests. This scenario most time force farmers' to

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sell their farm produce immediately after harvesting, only for them to buy it back at an exorbitant price in few months after harvesting. The potential increase in income and greater livelihood security will not be achieved if farmers' always sell surplus at the point of production (Saran *et al.*, 2012).

Babaloia *et al.* (2014) reported that increase in food production in Nigeria and the world in general calls for knowledge on post-harvest technologies of agricultural produce in order to achieve food security, improvement in shelf-life of agricultural products, income generation and improved livelihood of both rural and urban populace. The ability to understand the factors that contribute to post-harvest losses in yam among farmers' is very vital during harvesting and handling of farm produce. Factors such as improper post-harvest sanitation, unsuitable packaging materials and storage practices contributed to post-harvest losses in yam (Idah *et al.*, 2015).

Objectives of the study

The aim of this study is the evaluation of farmers' knowledge on post-harvest technologies of yam in Kogi and Niger States, Nigeria. The specific objectives of the study are to:

i. describe the socio-economic characteristics of the respondents in the study areas;
ii. determine the types of post-harvest technologies used for yam;
iii. evaluate the farmer's knowledge level on post-harvest technologies of yam and
iv. examine the problems with post-harvest technologies adopted by farmers.

METHODOLOGY

Study Area

Kogi State is one of the State where this research was carried out. The State was created in August, 1991 out of Kwara and Benue States. The State is located in the Guinea savannah ecological zone of Nigeria. The headquarters of the State is Lokoja, which is situated at the confluence of rivers Niger and Benue making the State to be popularly known as the Confluence State. The State like any other State in the country has three senatorial districts (Western, Central and Eastern senatorial districts). The State consists of 21 Local Government Areas (LGAs). The State is located between latitude 6° 33' and 8° 44' N and longitude 5° 22' and 7° 49'E. The State share common boundaries with Niger, Plateau, Nasarawa States and Federal Capital Territory (FCT) to the North and Benue State to the East. To the west, it is bounded by Kwara, Ondo and Ekiti state and to the South by Enugu, Anambra and Edo States. Kogi State has a total population of 3,278,487 in (NPC, 2006) and with growth rate of 3.2%, the State has estimated population of 4,636,071 in 2017. The State has land area of about 30,354.74 square kilometers (Kogi State Ministry of Information working document, 2016).

Niger State

Niger State is the other State where this research was conducted. The State is found in the Guinea Savannah ecological zone of Nigeria. In terms of land mass, it is the largest state in Nigeria. It covers a total land area of 74,224km² thus accounting for about eight percent of Nigeria's land area. About 85% of its land area is good for arable crop production (Niger State Ministry of Information, 2012). It is located within longitude 3° 30' and 7° 20' East & latitude 8° 20' and 11° 30' North, with a population of about 3,950,249 (NPC, 2006) and with a growth rate of 3.2%, the State has an estimated population of 5,586,000 in 2017 (Niger State Geographical Information System, 2015). Eighty-five percent of the State's population are farmers. The State is bordered to the north by Zamfara State, to the northwest by Kebbi State, to the south by Kogi State, to southwest by Kwara State; while Kaduna State and the Federal Capital Territory bordered the State to northwest and southwest respectively. Furthermore, the State shares a common international boundary with the Republic of Benin at Babanna in Borgu Local Government Area (Niger State Ministry of Information, 2012).

Sampling procedure and source of data

Multi-stage sampling technique was employed for this study in both States. The first stage involved random selection of three (3) Agricultural zones in both States. The second stage involved the selection of one (1) Local Government Areas from each of the zones making a total number of six (6) LGAs from both States. The third stage involved random selection of four (4) communities each from the selected LGAs making a total of twenty four (24) villages. The fourth stage involved the use of proportional sampling to select 10% of the respondents from the sampling frame which gave a total of 340 respondents.

Primary data was used for this study. Data was collected by researchers assisted by trained enumerators using structure questionnaire and interview schedules.

Analytical techniques

Objectives i and ii was achieved using descriptive statistics such frequency distribution, percentage and mean. Objective iii was achieved by carrying out knowledge test for the respondents The knowledge test was based on the post-harvest technologies used for crops produce by the respondents. A total of twenty (20) post-harvest technologies knowledge questions were subjected to knowledge test. Knowledge scores was recorded for each respondents and this serve as the dependents variable for this research. Each of the statements carried a full weight of one (1). Respondents were asked to choose one response against alternative responses as right, wrong or I don't know. For each right response, a farmer receives a full weight of 1, for each wrong or I don't know, a farmer receive 0. Thus the knowledge scores range from 0 to 100, where ≤25= low knowledge, 26-50= medium knowledge, 51-75= Slight high Knowledge, while ≥76= high knowledge.

To examine the problems with post-harvest technologies adopted by farmers (iv), the Kendall's coefficient of concordance (W) described by Mattson was used to rank the problems. A lowest mean rank indicates the problem is most pressing while highest mean rank indicate that the problem is least pressing. The Kendall's W was computed using the formular shown below.

$$W=\frac{12\sum R^{-2}i-3N(N-1)^2}{N(N-1)}$$

Where:

W = Kendall's value,

N = total sample size,

R = mean of the rank. The Kendall's coefficient of concordance (W) is a measure of the extent of agreement or disagreement among farmers of the rankings obtained. The value of W is positive and ranges from zero to one where one denotes perfect agreement among farmers of the rankings and zero denotes maximum disagreement.

RESULTS AND DISCUSSION

Socio-economic Characteristics

Table 1 present the results on the socio-economic characteristics of the respondents. It revealed that majority of respondents (82.5%) and (80.0%) in Kogi and Niger States were males. The pooled results indicated that 81.2% respondents were males. This findings showed that majority of respondents in the study area were males. Males' dominance implies that men played important role in post-harvest activities than women. This findings agreed with Rashid *et al.* (2015) who revealed that majority of farmers in Ekiti State are males.

The mean age of respondents in Kogi State according to Table 1 was 42.8 years, while that of Niger State was 42.8 years. The pooled results indicated a mean age of 42.6 years, this results revealed that farmers in both State were still within their active age, young, versatile, fully energetic, incline, and this may influence their readiness to try new innovation, acquire new skills and new knowledge on every aspects of post-harvest technologies. This affirm the findings by Chikazunga and Paradza (2014) who reported that majority of the farmers in Limpopo were still within their active age

Table 1 revealed that majority (87.2%) and (79.4%) of the respondent in Niger and Kogi States were married. Also, the pooled results revealed that majority (83.5%) of respondent were married. This findings indicated that larger proportion of the farmers' from both States were married which implies high level of responsibilities. This findings is in consonance with Dimelu *et al.* (2014) who reported that majority of the rural farmers were married in Enugu State, Nigeria. They also indicated that the mean household size of the respondents in Niger State was 9.0 persons which is higher than that of Kogi State that stands at 7.0 persons. Also, the pooled mean household size of respondents was 8.0 persons. This findings revealed that farmers from both States had moderate household size. This findings agreed with Modi (2017) who argued that majority of farmers in rural province of South Africa had moderate household size.

The mean farming experience in Kogi State according to Table 1 was 28.9 years while that of Niger was 26.2 years. The pooled mean farming experience of respondents was 27.4 years. This findings implied that farmers from both States have high experience and well exposed in farming which might had equipped their knowledge and skills on post-harvest technologies.

Table 1: Distribution of farmers according to socio-economic characteristics

Variables	Kogi State (n=160) Freq (%)	Niger State (n=180) Freq (%)	Pooled (n=340) Freq (%)
Sex			
Male	132 (82.5)	144 (80.0)	276 (81.2)
Female	28 (17.5)	36 (20.0)	64 (18.8)
Age (year)			
≤30	34 (21.2)	31 (17.2)	65 (19.1)
31-40	33 (20.6)	45 (25.0)	78 (22.9)
41-50	57 (35.6)	67 (37.2)	124 (36.5)
51-60	28 (17.5)	34 (18.9)	62 (18.2)
>60	8 (5.0)	3 (1.7)	11 (3.2)
Mean	42.8	42.4	42.6
Marital status			
Single	20 (12.5)	15 (8.3)	35 (10.3)
Married	127 (79.4)	157 (87.2)	248 (83.5)
Separated	3 (1.9)	1 (0.6)	4 (1.2)
Widow	5 (3.1)	4 (2.2)	9 (2.6)
Divorced	5 (3.1)	3 (1.7)	8 (2.4)
Household size (number)			
1-5	71 (44.4)	42 (23.3)	113 (33.2)
6-10	64 (40.0)	89 (49.4)	153 (45.0)
11-15	23 (14.4)	41 (22.8)	64 (18.8)
16-20	2 (1.2)	4 (2.2)	6 (1.8)
>20	-	4 (2.2)	4 (1.2)
Mean	7.0	9.0	8.0
Experience in Farming (year)			
1-10	17 (10.6)	15 (8.3)	32 (9.4)
11-20	29 (18.1)	48 (26.7)	77 (22.6)
21-30	40 (25.0)	60 (33.3)	100 (29.4)
31-40	41 (25.6)	39 (21.7)	80 (23.5)
>40	33 (20.6)	18 (10.0)	51 (15.0)
Mean	28.9	26.2	27.4

Sources: Field Survey, 2018

Types of Post-harvest Technologies in Yam

Table 2 contains the results of respondents according to post-harvest technologies in yam. The distribution of respondents according to sorting methods indicated that majority (99.4%) of respondents used manual sorting in Kogi State which is much greater than 52.2% in Niger State. The pooled results indicated that 74.4% of the respondents used manual sorting in yam. This implies that manual sorting is mostly used for yam in both States. More so, the distribution of respondents according to grading method in yam revealed that majority (95.6%) of respondents in Kogi State used manual grading which is far higher than 48.3% of respondents that used manual grading in Niger State. The lower percentage witnessed in Niger might be due to the fact that most of the respondents sampled were not fully into yam production compare to Kogi State. This findings showed that manual grading is mostly used by the respondents in both States as the pooled results indicated that 70.6% of the respondents used manual grading of yam tubers.

Furthermore, the distribution of respondents according to packing materials in Kogi State revealed that majority (83.8%) used traditional basket while 38.1% used head pan while that of Niger indicated that 36.1% of respondents used head pan, 25.6% used traditional basket. The pooled distribution of respondents according to packing materials showed that 52.9% of respondents used traditional baskets in packing of yam while 37.1% used head pan. This findings revealed that traditional basket and head pan were mostly used in packing of yam in both States. The types of packing materials in yam can contribute to post-harvest losses which go a long way in affecting income and livelihood of farming families. This findings agreed with Okoedo and Onemolease (2014) who indicated that traditional basket was the most packing material for yam in Edo State, Nigeria.

More so, the distribution of respondents according to storage materials in yam adopted in Kogi State showed majority (76.2%) used barn compare to 32.8% in Niger State, while the pooled results according to Table 2 showed that 53.2% of the respondents used barn for yam storage. The findings according to storage materials showed that barn, pit hole dug on ground and grass silo and bare floor were mostly used to store yam. This findings also agreed with Okoedo and Onemolease (2014) who indicated that most farmers in Edo State, Nigeria store their yam in the barn. In addition, the distribution of respondents according to method of transportation used shows that majority (76.9%) of respondents used motorcycle to transport yam tubers in Kogi State compare to 42.8% of respondents in Niger State. The pooled results indicated that 58.8% of respondents used motorcycle to transport yam tubers. This findings revealed that motorcycle is mostly used for yam transportation, this might be due to lack of motorable road to most farms.

The pooled results indicated that 39.4% of respondents preserved their yam by open air drying while 37.1% used ash/chalk to preserve their yam. This findings revealed that open air drying is mostly used in preserving yam in the study area. The use of open air drying reduce post-harvest farm losses and could contribute positively to farmers' income and livelihood. More so, pooled results according to Table 4.4 indicated that 58.2% processed yam to yam flour while 51.8% processed to pounded yam for consumption. The trend in Kogi showed that majorities (78.1%) processed to yam flour (Alubo or Lavu) compare to 58.2% while 42.2% processed to pounded yam in Niger State.

Table 2: Distribution of respondents according to post-harvest technologies in yam used by the farmers

Types of technologies	Kogi State (n=160) Freq (%)	Niger State (n=180) Freq (%)	Pooled (n=340 Freq (%)
Sorting			
Manual sorting	159 (99.4)	94 (52.2)	253 (74.4)
Grading			
Manual grading	153 (95.6)	87 (48.3)	240 (70.6)
Packing materials			
Traditional basket	134 (83.8)	46 (25.6)	180 (52.9)
Head pan	61 (38.1)	65 (36.1)	126 (37.1)
Sack bag	54 (33.8)	33 (18.3)	87 (25.6)
Storage methods			
Use of pit/hole dug on ground	82 (51.2)	45 (25.0)	127 (37.4)
Bare floor	78 (48.8)	23 (12.8)	101 (29.7)
Barns	122 (76.2)	59 (32.8)	181 (53.2)
Grass silo	46 (28.8)	66 (36.7)	112 (32.9)
Transportation methods			
Motorcycle	123 (76.9)	77 (42.8)	200 (58.8)
Lorry/truck	115 (71.9)	27 (15.0)	142 (41.8)
Bicycle	2 (1.2)	6 (3.3)	8 (2.4)
Preservation methods			
Ash/chalk	105 (65.6)	21 (11.7)	126 (37.1)
Sun drying	90 (56.2)	35 (19.4)	125 (36.8)
Open air drying	76 (47.5)	58 (32.2)	134 (39.4)
Processing methods			
Pounded yam	100 (62.5)	76 (42.2)	176 (51.8)
Yam flour (Lavu or alubo)	125 (78.1)	73 (40.6)	198 (58.2)

Sources: Field survey, (2018)
***multiple responses**

Farmers' knowledge on post-harvest technologies of yam

The distribution of respondents according to knowledge of farmers' on post-harvest technologies on yam using knowledge test is presented in Table 3. The findings in Kogi State revealed that 53.1% of farmers had high knowledge on post-harvest technologies of yam while 46.7% of respondents in Niger State had very low knowledge about post-harvest technologies of yam. The results revealed 36.2% of respondents had medium

knowledge on post-harvest technologies of yam according to pooled results while 34.7% had high knowledge on post-harvest technologies of yam. The pooled results of Kogi State indicated high and medium knowledge on post-harvest technologies of yam, while that of Niger State was extremely different.

It can be seen that respondents from both States had medium knowledge about post-harvest technologies of yam. However, this is not too good because it could lead to high probability of experiencing post-harvest farm losses which will go a long way in determining farmers' income and livelihood. This findings agreed with Javed (2013) who stated larger proportion of farmers in Bangladesh had medium knowledge on post-harvest practices of vegetables.

Table 3: Knowledge of farmers on post-harvest technologies of yam

Knowledge levels	Kogi State (n=160) Freq (%)	Niger State (n=180) Freq (%)	Pooled (n=340) Freq (%)
Very low knowledge	3 (1.9)	84 (46.7)	87 (25.6)
Low knowledge	9 (5.6)	3 (1.7)	12 (3.5)
Medium knowledge	63 (39.4)	60 (33.3)	123 (36.2)
High knowledge	85 (53.1)	33 (18.3)	118 (34.7)

Sources: Field Survey, 2018

Problems associated with Post-harvest Technologies Adopted

Objective iv was achieved using kendall coefficient of concordance and the results are presented in Table 4. The mean rank for each problem was calculated and problems with the lowest mean rank is said to be the most pressing. According to pooled results, the Kendell's coefficient of concordance obtained in the analysis was 0.76 and was significant at 1% level of probability, suggesting that 76.0% of the respondents agreed on the outcome of the rankings. The trend in Kogi State revealed 21.0% level of probability while Niger State was 98.0% level of probability. The scenario in Niger State showed a strong agreement on the outcome of ranking while Kogi State showed a weak agreement.

Table 4: Distribution of respondents according problems with post-harvest technologies adopted

Problems	Kogi State (n=160) Mean ($\bar{x}$)	Rank	Niger State (n=180) Mean ($\bar{x}$)	Ranks	Pooled (n=340) Mean ($\bar{x}$)	Ranks
Quick deterioration of crops	12.52	5th	7.61	1st	8.06	1st
Inadequate credit facilities	8.47	2nd	8.34	2nd	8.40	2nd
Shortage of fund	7.74	1st	8.35	3rd	8.44	3rd
Inadequate training on post-harvest	10.88	4th	11.8	5th	8.63	4th
High cost of post-harvest materials	8.52	3rd	8.37	4th	9.31	5th
Kendall's W	0.21		0.98		0.76	
Chi-Squared	316.324		318.564		463.653	
Degree	18		18		0.000	
Asymptotic significant	0.000		0.000			

Source: Field Survey, 2018

Five problems were identified as key problems faced by farmers in the post-harvest technologies adopted. The pooled results according to Table 4 revealed that quick deterioration of crops ($\bar{X} = 8.1$) was ranked 1st as the most pressing problem faced by farmers in the adoption of post-harvest technologies. The 2nd most pressing problem

was inadequate credit with mean value of ($\bar{X}$ = 8.40), this was followed by shortage of fund ranked 3rd with mean value of ($\bar{X}$ =8.44). This findings agreed with Mohammed *et al.* (2018) who indicated that shortage of fund and inadequate access to credit were the major constraints affecting soybean beans production in Northern Region of Ghana. Similar findings by Maxwell (2014) showed that inadequate access to credit was the most pressing constraints affecting rice farmers in Sub-Sahara Africa. The 4th ranked problem was inadequate training on post-harvest with mean value of ($\bar{X}$ = 8.63). Also, high cost of post-harvest materials was ranked 5th with mean value of ($\bar{X}$ =9.31).

CONCLUSION

From the findings it could be concluded that 74.4% and 70.6% of respondents used manual sorting and grading in yam respectively. Also, it could be concluded that 36.2% of respondents had medium knowledge on post-harvest technologies of yam according to pooled results while 34.7% had high knowledge on post-harvest technologies of yam. Furthermore, the pooled results revealed that quick deterioration of crops ($\bar{X}$ = 8.1) was ranked 1st as the most pressing problem faced by farmers in the adoption of post-harvest technologies while inadequate credit with mean value of ($\bar{X}$ = 8.40) was the 2nd most pressing problem faced.

RECOMMENDATIONS

1. Credit and fund should be made available so that farmers could purchase post-harvest tools that are needed to enhance longevity of farmers' produce
2. Farmers should be trained and sensitized on every aspects of post-harvest technologies of yam in order to ensure reduced post-harvest losses to improve their income and livelihood.
3. Government should subsidize the cost of post-harvest materials and tools so that farmers' can access them at affordable price.

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