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ANALYSIS OF CONSTRAINTS TO EFFECTIVE CONTROL OF POST-HARVEST LOSSES OF SELECTED VEGETABLES AMONG RURAL FARMERS IN THE NORTH-CENTRAL, NIGERIA

Ukohol, F.Y.,[1*] and Nungwa, L.M.[1]
Institute of Food Security, Joseph Sarwuan Tarka University, Makurdi, Benue State, Nigeria.
Email: ukoholfrancis@gmail.com

Abstract

The study analyzed constraints to effective control of post-harvest losses of selected vegetables among rural farmers in the North-Central, Nigeria. It specifically ascertained the level of effectiveness of management strategies for controlling post-harvest losses of vegetables and identified constraints to effective control of post-harvest losses of vegetables. Purposive and simple random sampling techniques were employed to select 203 respondents from 5,340 registered pepper and tomato farmers from Benue, Nasarawa and Kogi States. Primary data were collected through the use of well-structured questionnaire and analysed with descriptive and inferential statistics. The result showed high effectiveness on use of improved harvesting techniques storage ($\bar{x}$=3.63) and use of Modified atmosphere packaging ($\bar{x}$=3.58). The result also revealed that socio-economic (Factor 1), infrastructure cum technological (Factor 2) and administrative/managerial factors (Factor 3) were the major categories of constraints to control of post-harvest losses of fruits in the area. The Kruskal-Wallis (H) test also found that there was no significant difference on the level of utilization (p = 0.7233) as well as on the level of effectiveness (p=0.3209) of strategies for controlling post-harvest losses of fruits across the States in the area. The study recommended that intervention by both government and other stakeholders in addressing post-harvest losses of vegetable should focus on socio-economic, infrastructure cum technological as well as the administrative/managerial factors in order to reduce post-harvest losses and enhance attainment of food security.

Keywords: *Analysis, Post-harvest, Losses, constraints, vegetables.*

1.0 Introduction

Post-harvest loss is one of the general problems facing production in Nigeria and it concerns everyone from the research scientists, to the extension/marketers, farmers on the farm, and the government policy formulators (Chukwunta, 2014). Post-harvest losses are the measurable qualitative and quantitative damages or spoilage after harvest

in the value chain caused by natural and artificial phenomena (Age, 2017). These losses affect both the quality and quantity of crop produce, thus reducing their economic value and the total income of the producers. In Nigeria, enormous quantities of fruits and vegetables are produced. For instance, 3.8 million tonnes of onions, 6 million tonnes of tomatoes, 10 million tonnes of plantain and 35 million tonnes of citrus are reportedly produced annually (Pandey *et al*., 2013; Ukohol and Agbarevo, 2021).

In spite of the high production figures churned out, the populace still suffers acute shortage of fruits and vegetables due to losses along the value chain. Olayemi *et al*. (2012) estimated that as much as 25% and 40% fruits and vegetables, respectively, are lost after harvest in River State, Nigeria due to poor post-harvest handling measures. Post-harvest losses of fruits and vegetables are estimated to be 20-40 percentage in developing countries (Kughur *et al*., 2015; Ngowi and Selejio, 2019; Kulwijila, 2021). These losses are said to have a major impact on socio-economic and food security status, particularly for people in the developing world (APHLIS, 2017).

In nigeria, as is the case with many other developing countries, post-harvest losses of fruits and vegetables are influenced by many factors/determinants ranging from growing conditions to handling at consumer level (Ngowi and Selejio, 2019; Kulwijila, 2021). Among the factors, there are also biological, chemical, mechanical, psychological, physiological, physical and environmental factors (Kader, 2005; Kitinoja, 2010; Atanda *et al*., 2011; Kereth *et al*., 2013 and Kulwijila, 2021).

A series of modern technologies have been developed and applied in post-harvest handling of agricultural crops in the developed countries. However, fruits and vegetable farmers in developing countries like Nigeria, and North-Central States in particular, have

not been able to use these advanced technologies, owing maybe to high cost, lack of management skills, lack of awareness, and inappropriate use of information sources for dissemination of information on post-harvest strategies or adaptability problem. Considering the critical nature of post-harvest losses and reduction in food security, it is very important to identify factors that constitute serious constraints to effective control of post-harvest losses of vegetables in Nigeria, especially in the North-Central.

2.0 Objectives of the Study

The broad objective of the study was to analyze constraints to effective control of post-harvest losses of selected vegetables (pepper and tomatoes) among rural farmers in the North-Central, Nigeria.

The specific objectives were to:

i. ascertain the level of effectiveness of management strategies used by farmers in controlling post-harvest losses of vegetables; and
ii. identify constraints to effective control of post-harvest losses of vegetables in the study area.

The following null hypotheses were tested;

H_o1: There is no significant difference in the level of utilization of management strategies by vegetable farmers across the States in North-Central Nigeria.

H_o2: There is no significant difference in the level of effectiveness of management strategies for controlling vegetable losses across the States in North-Central Nigeria.

3.0 Methodology

The study was conducted in the North-Central geo-political region of Nigeria,

otherwise referred to as middle belt. The region comprised six (6) States, and the Federal Capital Territory. The States are Benue, Kogi, Nasarawa, Plateau, Kwara and Niger, with a total land mass of 296,898 km2 lying roughly between latitudes 6 1/20N and 8 1/20 N longitudes 7 1/20 E and 100 E (Federal Ministry of Agriculture (FMARD), 2015). The region has a projected total population of 31,735728 people at 3 % growth rate (NPC, 2006). The region is bounded in the North by Bauchi, Kaduna, Zamfara, and Kebbi States; in the South by Cross- River, Ebonyi, Enugu, Edo, Ondo, Ekiti, Osun and Oyo States; in the East by Taraba State and Cameroon; and in the West by the Republic of Benin. Average annual rainfall varies between 1,250mm and 175mm from the Southern to the Northern parts with annual temperatures variations of 32°C - 38 °C. The region is predominantly rural with agriculture being the mainstay of it's economy.

The population of the study consists of 5,340 (ADP, 2018) tomato and pepper farmers in Benue, Nasarawa, and Kogi States of North-Central Nigeria. A sample size of 203 respondents was selected using a multi-stage sampling procedure. In the first stage, three States from the region were purposively selected, based on their level of production of fruits and vegetable crops. The States selected include Benue, Nasarawa and Kogi States. The second stage also involved purposive selection of two Local Government areas from each of the States selected, based on their level of involvement in the production of fruits and vegetable crops. The Local Government Areas from Benue State include; Ushongo and Gboko, while Akwanga and Lafia were selected from Nasarawa State. Also from Kogi State, Ajaokuta and Ankpa were selected bringing the total Local Government Areas to six (6).

The third stage of selection involved the use of simple random sampling technique in the

selection of two communities from each of the Local Government Areas selected, making a total of twelve (12) communities. The last stage of sampling was selection of 203 respondents through simple random sampling technique corresponding to 3.8% of the sampling frame obtained from the various States' Agricultural Development Projects (ADPs) to ensure proportionality. Primary data were collected by using structured questionnaire. Data collected for this study were analyzed using both descriptive and inferential statistics.

3.1 Model Specification

3.1.1 Factor analysis can be expressed as follows:

$F_1 = \alpha_1 X_1 + \alpha_{12} X_2 + *** + \alpha_{1n} X_n$

$F_2 = \alpha_{21} X_1 + \alpha_{22} X_2 + *** + \alpha_{2n} X_n$

$F_n = \alpha_{n1} X_1 + \alpha_{n2} X_2 + *** + \alpha_{nn} X_n$

Where;

$F_1, F_2, * * * F_n$ = unobserved underlined factors affecting the control of post-harvest losses

$\alpha_1, \alpha_2 * * * \alpha_n$ = Factor loadings or correlation coefficients

$X_1, X_2, * * * X_n$ = Observed variables/ factors affecting the control of post-harvest losses

$F_n < X_n$ = Necessary condition that must be met in factor analysis

Factor analysis interpretation was based on Kaiser's (1958) rule of thumb which states that variables with correlation coefficient of 0.30 or more have higher loadings and so such are qualified to be used in classifying or naming a factor, while variables below 0.30 are not named.

3.12 Kruskal Wallis (H) test

The Kruskal Wallis (H) test model is expressed thus;

$H = 12/N(N+1) \times \sum Ri^2/ni - 3(N+1)$

Where;

H=Kruskal Wallis

N=Total No. of observations over all samples

ni= Sample size of samples i

R^2i= Square of the sum of rank for sample i

$\sum Ri^2/ni$= the squares of sum of ranks divided by the corresponding sample size (ni) in the samples as are summed across all samples.

4.0 Results and Discussion

4.1 Level of effectiveness of post-harvest management strategies for controlling vegetable losses.

Table 1 shows the result on the level of effectiveness of post-harvest management strategies for controlling vegetable losses in the study area. The overall result revealed high effectiveness of the strategies, with a grand mean ($\bar{x}$=3.20), higher than the decision mean cut-off ($\bar{x}$=2.55). The result shows high level effectiveness on all the strategies listed. All the variables had a standard deviation of less than 1. This indicates that there is consensus in the responses of the respondents as regards the level of effectiveness of the management strategies. The most effective strategies include; the use of improved harvesting techniques ($\bar{x}$=3.66), use of refrigerator, evaporative coolers and oven for storage ($\bar{x}$=3.63), use of Modified Atmosphere Packaging for packaging ($\bar{x}$=3.58), use of refrigerator containers and trucks for transportation ($\bar{x}$=3.58), processing/preservation using calcium chloride, methylchlopropene and post heat treatment ($\bar{x}$=3.54).

The findings corroborates those of Ahmed (2013), who reported that sophisticated management and new technologies continue to improve efficiency with

which food is brought into stores, displayed and sold. This is further supported by Armachius and Zikankuba (2017) who discovered that the use of post-harvest technologies such as application of ethylene-1-methylchlopropene (MCP) can enhance delay ripening, respectively, and significantly reduce fruits and vegetable post-harvest losses throughout the value chain.

Table 1: Level of effectiveness of post -harvest management strategies for controlling vegetable losses in the study area

Strategies	Freq.		Standard Deviation
Harvesting at matured green stage	634	3.12	0.70
Use of improved harvesting techniques	742	3.66	0.58
Precooling after harvesting	742	2.88	0.63
Effective extension service delivery	565	2.78	0.57
Use of good quality planting materials	598	2.95	0.66
Proper cleaning and handling of crop produce	605	2.98	0.62
Packaging (Use of modified Atmosphere packaging)	727	3.58	0.74
Storage (Refrigerator, evaporative coolers, Oven)	756	3.63	0.72
Processing/preservation Using calcium chloride,	719	3.54	0.77
Methylchlopropene and Post heat treatment.			
Transportation (Refrigerator containers and trucks)	727	3.58	0.72
Transporting during the cool part of the day	600	2.96	0.61
Sorting healthy produce from unhealthy ones and grading	575	2.83	0.60
Provision of marketing information	567	2.79	0.73
Provision of improved rural infrastructure	687	3.38	0.83
Agricultural insurance	586	2.89	0.85
Establishment of Agro -based industry	713	3.51	0.77
Grand Mean		**3.20**	

Source: *Field Survey (2023)*

information on post-harvest technologies (0.4137), high cost of chemical preservatives (0.5706), high cost of labour (0.0.4294), lack of marketing information (0.5086), and poor education and knowledge (0.3354).

The infrastructure cum technological factors include lack of electricity (0.4484), lack of packaging facilities (0.6333), lack of handling and processing skills (0.4277), lack of effective transport and distribution system (0.3608), climate change (0.5343), poor state of rural roads (0.5397) and lack of storage and processing facilities (0.4224). The administrative/managerial factors on the other hand include lack of effective extension services (0.4298), lack of data base on post-harvest losses (0.4914), lack of quality standard and differential pricing system (0.3281), lack of policy framework on post-harvest losses (0.3462) and lack of political will (0.3261).

This result agrees with Rathiel, *et al*., (2018), Mbah, *et al.,* (2017), Amir (2017), Sharm, (2016) who identified constraints to post-harvest management of vegetables to include lack of proper information sharing mechanism, inadequate infrastructure and facilities, insufficient resources (tools and equipment), weak enforcement of policies, lack of extension programs and improper marketing channels, lack of awareness, market access, and poor post-harvest handling practices, lack of trained manpower, lack of electricity, high taxation, as well as low access to credit.

Table 2: Factor analysis of constraints to post-harvest management of vegetables in the study area

Constraints	Factor 1	Factor 2	Factor 3
Lack of electricity	0.2213	0.4484**	0.2755
Lack of credit facilities	0.4104*	0.0427	0.2524
Lack of good quality planting materials	0.1076	0.2742	0.1945
Ineffective marketing channels	0.3003*	0.2444	0.1945
Lack of packaging facilities	0.0525	0.6333**	0.2804
Lack of training on control of post-harvest losses	0.3485*	0.2793	0.2544
Lack of handling and processing skills	0.0776	0.4277**	0.1896
Lack of information on post-harvest technologies	0.4137*	-0.0049	0.1440
Lack of effective transport and distribution system	0.1978	0.3608**	0.1845
Lack of effective extension services	0.0809	0.2844	0.4298***
High cost of chemical preservatives	0.5706*	0.0734	0.0788
High cost of labour	0.4294*	-0.0432	0.2714
Climate change	0.1269	0.5343**	0.0951
Poor state of rural roads	0.1978	0.5397**	0.0968
Lack of marketing information	0.5086*	0.0312	0.0805
Lack of data base on post-harvest losses	0.2266	-0.0174	0.4914***
Lack of storage and processing facilities	0.1070	0.4224**	-0.1263
Lack of quality standard and differential pricing system	0.1717	0.2748	0.3481***
Lack of policy framework on post-harvest losses	0.0448	0.1861	0.3462***
Lack of incentives to farmers	0.1926	0.1941	0.2698
Lack of political will	0.2907	0.0185	0.3261***
Lack of human, economics and technical resources	0.1151	0.2230	0.2645
Poor education and knowledge	0.3354*	0.1794	0.1304

Source: *Field Survey (2023).*

Rotational Method: Varimax, *significant in factor 1 (Socio -economic factors)
**significant in factor 2 (Infrastructure cum technological factors)
***significant in factor 3 (Administrative /managerial factors)
< 0.30- Not significant

4.3 Test of significance in the level of utilization of management strategies for controlling post-harvest losses of vegetable across the States in North-Central, Nigeria.

The result in Table 3. showed the Kruskal Wallis (H) Equality rank test of difference strategies used for controlling post-harvest losses of vegetable across the States in North-Central, Nigeria. The study showed that the Kruskal-Wallis (H) test was not statistically significant in the level of strategy used for controlling post-harvest losses of vegetable

across the States in North-Central Nigeria, with a $\chi 2(2) = 0.648$, $p = 0.7233$ greater than 0.05, and a mean rank pain score of 8673.50 for Benue, 6273.00 for Nasarawa, and 5759.50 for Kogi States. The study therefore accepts the null hypothesis, and concludes that the level of strategy used for controlling post-harvest losses of vegetables across the States in North-Central, Nigeria is equal across the three States.

Table 3: Kruskal Wallis (H) Equality rank test of level of utilization of strategies for controlling post -harvest losses of vegetable across the States North -Central, Nigeria

States	Observation	Rank Sum
Benue	82	8673.50
Nassarawa	64	6273.00
Kogi	57	5759.50
chi-squared	0.648	
Df	2	
Probability	0.7233	
chi-squared with ties	0.660	
Probability	0.7148	

Source: *Field Survey (2023)*

Table 4: Kruskal Wallis (H) Test of difference in level of effectiveness of managemet strategies used for controlling post-harvest losses of Vegetable across the States in North-Central, Nigeria

The result of Kruskal-Wallis (H) test among the vegetable farmers showed that there was non- statistically significant difference in the level of effectiveness of management strategies among fruit farmers across the States in North-Central, Nigeria with a chi-squared of 2.273 at probability value of 0.3209 greater than 0.05, and a mean rank score of 10234.00, 3535.00 and 2884.00 for Benue, Nassarawa and Kogi States respectively. The

study, therefore, accepts the null hypothesis which states that there is no significant difference in the level of effectiveness of management strategies among vegetable farmers across the States in North-Central, Nigeria.

States	Observation	Rank Sum
Benue	82	10234.00
Nassarawa	64	3535.00
Kogi	57	2884.00
chi-squared	2.273	
Df	2	
Probability	0.3209	
chi-squared with ties	2.296	
Probability	0.3173	

Source: *Field Survey (2023)*

5.0 Conclusion and Recommendations

The study concluded that there was high level of utilization of management strategies for controlling post-harvest losses of vegetables. Socio-economic, infrastructure cum technological and administrative/managerial factors was the major category of factors influencing the utilization of post-harvest management strategies of vegetables. There was no significant difference in the level utilization as well as effectiveness of management strategies used for controlling post-harvest losses among vegetable farmers across the three States in North Central Nigeria.

It was recommended that intervention by both government and other stakeholders in

addressing post-harvest losses of vegetable should focus on socio-economic, infrastructure cum technological as well as the administrative/managerial factors in order to reduce post-harvest losses and enhance attainment of food security.

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