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ASSESSMENT OF EFFECTS OF POST-HARVEST LOSSES OF SELECTED FRUIT CROP PRODUCE ON 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 assessed effects of post-harvest losses of selected fruit crop produce on rural farmers in North-Central, Nigeria. It specifically estimated the quantity and monetary value of selected fruits lost and ascertained the level of utilization of management strategies for controlling post-harvest losses of fruits crop produce. Purposive and simple random sampling techniques were employed to select 182 respondents from 4865 registered mango and orange farmers from Benue, Nasarawa and Kogi States. Primary data were collected through the use of structured questionnaire and analysed using descriptive and inferential statistics. Fruit farmers had mean quantity loss of 420.69kg and monetary value of N105,528.8. Fruit framers recorded high ($\bar{x}$= 2.01) level of utilization of the strategies used for controlling post-harvest losses. Tobit regression estimates showed that coefficients of sex (-0.0177), marital status (0.0137) and farming experience (0.0013), influenced strategies used for controlling post-harvest losses of fruit crop produce in the study area. ANOVA result showed a significant difference in quantity of fruits loss (0,004) at 5% level of probability across the states in the area. It was concluded that, fruit crop produce had highest case of losses and monitory losses due to post-harvest losses in the area. It was recommended that, government policies aimed at post-harvest loss interventions of fruits should consider establishment of fruit juice factories to reduce post-harvest losses of fruit produce in the North-Central Nigeria.

Keywords: *Post-harvest, Losses, Assessment, effects, fruits-crop produce.*

1.0 Introduction

Fresh fruits and vegetables are essential sources of vitamins and minerals for humans (Kulwijila, 2021). The quality and nutritional worth of fresh fruit crop produce is

affected by postharvest handling and storage conditions, which eventually cause post-harvest losses (Sablani *et al*., 2006; Alidu *et al*., 2016). However, post-harvest storage and loss prevention strategies in developing countries such as Nigeria are still negligible as compared to primary production related activities (Ngowi and Selejio, 2019; Kulwijila, 2021). Postharvest loss can be defined as the degradation in both quantity and quality of fruit crop produce from harvest to consumption. Quality losses include those that affect the nutrient/caloric composition, the acceptability, and the edibility of a given produce (Kiaya, 2014; Oladimeji *et al*., 2019).

The estimates of post-harvest losses of fruit crop produce vary widely across countries depending on the crop, season, and post-harvest management practices undertaken (Kodwo *et al.*, 2016). For example, 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). According to Kasso and Bekele, (2018); Muhammad and Yakubu (2023) one-third (equivalent to 1.3 billion tonns) of the food produced for human consumption is lost or wasted yearly; with global economic losses amounting to about US$940 billion annually. 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, is faced with post-harvest losses of fruits and vegetables along their value chains. The losses 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). Despite the fact that these factors are well known in the literature and many technologies have been developed to reduce these losses, they have eventually not been confirmed. This was due to little attention paid to effects to post-harvest losses of fruits and vegetables in Nigeria and elsewhere (Kader, 2005). According to Klink (2015) and Kulwijila (2021), to achieve a sustainable positive impact in reducing post-harvest losses in developing countries, the effects should be detected. This study therefore analysed effects of post-harvest losses along their value chain in the North-Central, Nigeria

1.1 Objectives of the Study

The broad objective of the study was to assess effects of post-havest losses of mango fruits on rural farmers in the North-Central, Nigeria.

The specific objectives were to:

i. estimate the quantity and monetary value of mango fruits lost in the last cropping season,
ii. ascertain the level of utilization of post-harvest management strategies by fruits farmers.

1.1 Hypotheses of the Study

The following null hypotheses were tested:

$H0_1$: Selected socio-economic characteristics of the respondents do not have significant effect on strategies used for controlling post-harvest losses of

fruits in North-Central Nigeria.

$H0_2$: There is no significant difference in the quantity of fruits lost across the States in North-Central, Nigeria**.**

$H0_3$: There is no significant difference in the monetary value of fruits lost 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 and longitudes 7 1/20 E and 100 E (Federal Ministry of Agriculture (FMARD), 2015a). 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 temperature variations of 32^{o}C 38 ^{o}C. The region is predominantly rural with agriculture being the mainstay of its economy.

The population of the study consists of 4865 (ADP, 2018) mango and orange farmers in Benue, Nasarawa, and Kogi States in the North-Central Nigeria. A sample size of 182 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 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 182 respondents through simple random sampling technique corresponding to 3.8% of the sample 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 by using both descriptive and inferential statistics. Objectives 1and 2 were achieved by using descriptive statistics such as frequencies, means percentages and standard deviation. Hypothesis one ($H_0$1) was tested using Tobit Regression Model, while hypotheses two ($H_0$2) and three ($H_0$3) were tested using ANOVA Model.

3.1 Model Specification

3.1.1 Tobit Regression Model used for testing hypothesis 1 specified as;

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, \ldots\ldots\ldots X_9 + ei)$$

Y_i = strategies used by farmers in controlling post-harvest losses of selected fruits and vegetables (mean)

X_1 = Age of the farmer (years)

X_2 = Sex (Male=1, Female=0)

X_3 = farm Income (Naira)

X_4 = Household size (No. of persons in a household)

X_5 = Farming experience (years)

X_6 = Educational level of the farmers (years)

X_7 = Marital status (Married = 1, Otherwise =0)

3.1 .2 ANOVA model for hypotheses 2 and 3 is implicitly specified as;

$$F = \frac{MSSB}{MSSW} = \frac{SSB}{SSW} = \frac{n-k}{k-1}$$

$SSB = 3nj\,(X-X)^2$

$SSW = 3n\,(Xi-X)^2$

Where F = Value by which the statistical significance of the mean differences was judged

SSB = Sum of squared deviation between samples

n= number of observation

k= number of samples

nj= sample size from population j

Xj = mean of sample for population j

X = grand mean

Xii = nth observation from population

4.0. Results and Discussion

4.1 Quantity and Monetary Value of Fruits Lost in the Last Cropping Season

Table 1 shows the quantity and monetary value of mango and citrus fruits lost in the last cropping season. The result on quantity of fruits loss shows that majority (51.65%) of the respondents lost between 0-399kg. The result also shows a mean quantity loss of 420.69kg in the 2022 cropping season. The result on the monetary loss shows that majority (96.15%) of the respondents lost between 0-249,999 Naira, and also a mean monetary loss of N105,528.80. The high losses in quantity of fruits recorded implies that, post-harvest management techniques were not yet adequately utilized in the area, with a resultant high level of spoilage, reduced availability and quality of produce. The high monetary loss indicates that fruits farmer in the area experience a high level of economic losses due to the income lost. This result is supported by Kughur *et al*. (2015) who

reported that 48.5% of fruits and vegetable producers lost about $30.5 on annual basis, 35% lost at least 1,000Kg of fruits and vegetables on annual basis in Gboko Local Government Area of Benue State. The findings further corroborates with those of Desta (2018) who estimated that about 30 to 40% of total fruits production is lost between

Table 1: Quantity and monetary value of mango and citrus fruits lost in cropping season in the study area (n=182)

Qty. Lost (kg)	Freq.	Percentage	Mean
0-399	94	51.65	
400-799	72	39.56	
800-1199	12	6. 59	**420.69**
1200-1599	4	2.20	
Total	**182**	**100.00**	
Monetary Value (₦)	**Freq.**	**Percentage**	**Mean**
0-249,999	175	96.15	
250,000 -499,999	7	3.85	**105,528.8**
Total	**182**	**100.00**	

Source: *Field Survey (2023)*

4.2 Level of Utilization of Post-harvest Management Strategies by Fruit Farmers

Table 2 shows that the level of utilization of post-harvest management strategies by fruit farmers was relatively high with a grand mean ($\bar{x}$=2.01) which is higher than the decision mean cut-off ($\bar{x}$=2.05). The result showed high level utilization on use of quality planting materials ($\bar{x}$=2.79), proper cleaning and handling of crop produce ($\bar{x}$=2.76), harvesting at matured green state ($\bar{x}$=2.74), sorting healthy produce from unhealthy ones and grading ($\bar{x}$=2.73), transporting during the cool part of the day ($\bar{x}$=2.65), pre-cooling after harvesting ($\bar{x}$=2.58), The high level of utilization of these strategies could be due to their

indigenous nature, low cost of materials, less technical skills required. The standard deviation on the utilization of post-harvest management strategies of fruits were all less than1. This indicates uniformity in responses of the respondents that there is high utilization of post-harvest management strategies of fruits in the area. Low level of utilization recorded on some of the strategies could be due to their exogenous nature, high cost, high technical involvement, low knowledge of the user or lack of adequate training. The overall high utilization of the strategies disagrees with Ukohol and Agbarevo (2021) who reported that the adoption of endogenous post-harvest management practices of vegetable crop produce in Zone B Local Government Areas of Benue State, Nigeria was low.

Table 2: Level of utilization of postharvest management strategies by fruit in the study area(n=182)

	Total		Std. Dev.
Harvesting at matured green state	498	2.74	0.48
Use of improved harvesting techniques	283	1.56	0.64
Precooling after harvesting	469	2.58	0.58
Effective extension service delivery	419	2.30	0.52
Use of good quality planting materials	509	2.79	0.43
Proper cleaning and handling of crop produce	502	2.76	0.50
Packaging (Use of modified Atmosphere packaging)	502	1.34	0.64
Storage(Refrigerator, evaporative coolers, Oven)	224	1.23	0.48
Processing/preservation Using calcium chloride, Methylchlopropene and Post heat treatment.	252	1.39	0.56
Transportation (Refrigerator containers and trucks	263	1.45	0.62
Transporting during the cool part of the day	483	2.65	0.51
Sorting healthy produce from unhealthy ones and grading	496	2.73	0.49
Provision of marketing information	428	2.35	0.55
Provision of improved rural infrastructure	287	1.58	0.71
Agricultural insurance	247	1.36	0.64
Establishment of Agro-based industry	248	1.36	0.61
Grand Mean		**2.01**	

Source:*Field Survey, 2023*

4.3 Test of Hypotheses

Hypothesis 1:

Table 3 shows the Tobit estimates of the socio-economic determinants of strategies used for controlling post-harvest losses of fruits in North-Central Nigeria

The results showed that adjusted R^2 was 0.5041, implying that the factors in the model accounted for only 50.41% of the variation in the probability of using the management strategies. This means that there are other variables that affect the respondents' probability to use post-harvest management strategies which were not captured in the regression model. The Chi-squared value (147.47) was highly significant (P=0.0000) at 1% level of probability, indicating goodness of fit of the Tobit regression line. Out of seven variables estimated by the study, only three were found with significant values and thus, were discussed.

The coefficient for sex (-0.0177) of the respondents was negatively signed and significant (0.007) at 1% level of probability. This implies that any increase in number of female fruit farmers will lead to increase in probability and intensity of strategy used for controlling post-harvest losses among fruit farmers in the study area. This confirmed the finding by Alysel *et al.* (2019) that all those involved in the process chain, as well as consumers bear the responsibility for handling resources sparingly, protecting the environment and stemming food waste, which is now running worldwide at around 1.3 billion tons per year.

The coefficient for marital status (0.0137) was positive, and also found to be significant (0.008) at 1% level of probability, and positively related with the strategy used for controlling post-harvest losses among fruit farmers in the study area. This was an indication that increase in number of married farmers will lead to an increase in probability and intensity of strategy used for controlling post-harvest losses among fruit

farmers. A plausible explanation for these results could be due to access to additional household labour amongst married actors (Abera, et al., 2020).

The study also showed that the coefficient for farming experience (0.0013) was positive and significant (0.036) with strategy used for controlling post-harvest losses among fruit farmers in the study area at 5% level of probability. This implied that an increase in years of farming experience of the farmers will lead to a corresponding increase in probability and intensity of strategy used for controlling post-harvest losses among fruit farmers in the study area. Farmers with more years of experience seemed to be good in handling practices, hence the less post-harvest losses. These results are in conformity with observations by Kulwijila (2021) who found that post-harvest losses of kinnow fruit in Pakistan and banana in Ethiopia were positively and significantly influenced by experience. This showed that the use of strategies for controlling post-harvest losses improved with experience. The hypothesis which states that selected socio-economic characteristics of the respondents do not have any significant effect on strategies used for controlling post-harvest losses of fruits in North Central, Nigeria is hereby rejected.

Table 3: Tobit regression estimates of the socio -economic determinants of strategies used for controlling post -harvest losses among fruit farmers in the study area

Variables	Parameters	Coefficient	Standard Deviation	t-Ratio	P
Constant	β_o	2.0078	0.0758	26.47	0.000
Sex	X_1	-0.0177	0.0006	-2.68	-0.007*
Age of the respondents	X_2	0.0018	0.0020	0.09	0.929
Marital status	X_3	0.0137	0.0004	3.13	0.008*
Household size	X_4	-0.0022	0.0046	-0.48	0.634
Level of education	X_5	-0.0005	0.0104	-0.05	0.958
Farming experience	X_6	0.0013	0.0007	1.85	0.036**
Annual farm income	X_8	1.63e -08	9.04e -08	0.18	0.857
Chi ^{2} (χ^2)	147.47				
Probability chi ^{2}	0.0000				
Log likelihood	81.3214				
Pseudo R ^{2}	0.5041				

Source: *Field Survey (2023)* * $p \leq 0.01$, ** $p \leq 0.05$ and *** $p \leq 0.10$

Hypotheses 2:

The result in Table 4 showed the test of significant difference in quantity of fruits lost across the States of central, Nigeria.

The results showed that there was a significant difference in quantity of fruits loss across the States in North-Central Nigeria with f-value of 5.669, significant (0,004) at 1% level of probability. This can be explained possibly as a result of flow of information and knowledge on post-harvest losses among fruits famers across the States. This is supported by Aysel, *et al.,* (2019) who observed that adequate knowledge and information on post-harvest losses will lead to improvements in post-harvest technologies such as good harvesting practices and packaging systems which are vital to minimize post-harvest losses and to improve quality characteristics of fresh produce so that more fresh produce is actually consumed. The hypothesis which states that there is no significant difference in the quantity of fruits lost across the States in North-Central Nigeria is hereby rejected

Table 4: ANOVA Test of Significant Difference in the quantity of fruits lost across the States in the study area

Sources	Sum of Squares	Df	Mean	F	Sig
Between group	601919.946	2	300959.973	5.669	.004
Within group	9449662.650	180	53087.992		
Total corrected	10051582.597	182			

Source: *Field Survey (2023)*

Hypotheses 3:

Table 5 shows that there was a significant difference in the monetary value of fruits lost across the three states under study with f- value of 4.482 significant (0.013) at 5% level of probability. This implied that there was a significant difference in income lost from fruits

across the States in North-Central Nigeria. The hypothesis which state there is no significant differences in the income loss among fruit farmers across the States of North-Central Nigeria is hereby rejected

Table 5: Test of Significant Differences in the Monetary Value of Fruits Lost by farmers across the States in the study ar ea

Sources	Sum of Squares	Df	Mean Square	F	Sig.
Between groups	199578662652.49	2	99789331326.25	4.482	.013
Within groups	3985548485699 .15	180	22265633998.32		
Total corrected	4185127148351.65	182			

Source: *Field Survey, 2023*

5.0 Conclusion and Recommendations

5.1 Conclusion

It was concluded that fruit farmers experienced high quantity and monetary losses in the area. The level of utilization of post-harvest management strategies for controlling fruits losses was high. Sex, marital status, age and farming experience were the major determinants of strategies used for controlling post-harvest losses of fruits and vegetables in North-Central, Nigeria. There was a significant difference each in the quantity and income lost among fruit farmers in the area.

5.2 Recommendations

It was recommended that Post-harvest loss intervention of fruits should be designed based on an understanding of the local gender context, in partnership with women since women participation was significant, and with an eye to increasing their empowerment. In addition, government and the private sector should be encouraged to invest in postharvest processing technologies and establishment of agro-based industries.

References

Abera, G., Ibrahim, A. M., Forsido, S. F. and Kuyu, C. G. (2020). Assessment on post-harvest losses of tomato (Lycopersicon esculentem mill.) in selected districts of east Shewa zone of Ethiopia using a commodity system analysis methodology. Heliyon 6:e03749. doi: 10.1016/j.heliyon.2020.e03749

Alidu, A., Ali, E. B. and Aminu, H. (2016). Determinants of Post-Harvest Losses among Tomato Farmers in The Navrongo Municipality in The Upper East Region, Ghana. *Journal of Biology, Agriculture and Healthcare* 6(12): 14-20.

Alysel, E., Derya, K.Y., Yildiray, I., Nurcan, A.G., Arzu, Y. and Fahrettin, G. (2019). trategies to Reduce Post-Harvest Losses for Fruits and Vegetables. *International Journal of Scientific and Technological Research,* Vol. (3):29-40.

APHLIS, 2017. Estimating nutritional postharvest losses – the Nutri-P-Loss project. 27th July. https://www.aphlis.net/en. Retrieved online on the 28th of October, 2023.

Atanda, S. A., Pessu, P. O.,Agoda, S., Isong, I. U. and Ikotun, I. (2011). The concepts and problems of post-harvest food losses in perishable crops. *African Journal of Food Science,* 5 (11): 603-613.

Desta, B. (2018). Review on Factors Affecting Post-harvest Quality of Fruit. *Journal of Plant Science & Research Open Science Publications,* 5 (2): pp 1-5. ISSN: 2349-2805

Federal Ministry of Agriculture and Rural Development (FMARD) (2015a). The Geographical Location of North-Central States in Nigeria as Agricultural Zones.

Federal Ministry of Agriculture and Rural Development (FMARD) (2015b). The Statistical Report on Crops produce in States in Nigeria.

Kader, A. A. (2005). Increasing food availability by reducing post-harvest losses of produce. *Acta Horticulturae (ISHS)* 682: 2169-2176.

Kasso, M., and Bekele, A. (2018) Post-harvest loss and quality deterioration of horticultural crops in Dire Dawa region, Ethiopia. *Journal of the Saudi Society of Agricultural Sciences*, 17(1): 88-96.

Kereth, A. G, Lyimo, M., Mbwana, H.A., Mongi, R. J., and Ruhembe, C.C. (2013). Assessment of post-harvest handling practices: knowledge and losses in fruits in Bagamoyo District of Tanzania. *Journal of Food Science and Quality Management* 11: 2224-6088.

Khidir, A.A., Samaila, G. and Ekpa, D (2023). Socio-economic determinants of post harvest loss among cowpea farmers in Kurfi Local Government Area of Katsina State, Nigeria. *International Journal of Agricultural Extension* 12(1): 7-14

Kiaya, V. (2014). Post-harvest losses and strategies to reduce them. *Technical paper scientific and technical department. ACF International.*

Kitinoja, L. and Cantwell, M. (2010). *Identification of Appropriate Post Harvest Technologies for Improving Market Access and Income for Small Horticultural farmers in Sub-Saharan Africa and South Asia*. World Food Logistics Organization.

321pp.

Klink, R. (2015). Adaptation of post-harvest loss intervention. A case study in the Gulu and Oyam district, Northern Uganda. Thesis for the award of the degree of Master of Science in Management Economics and Consumer Studies at Wageningen University, the Netherlands, 56pp.

Kodwo, I. G.A. and Bright, K. D. T. (2016). Determinants of Yam Post-harvest Management in the Zabzugu District of Northern Ghana. Hindawi Publishing Corporation. 9pp.

Kughur, P.G., Iornenge, G.M. and Ityonongu, B.E. (2015). Effects of post-harvest losses on selected fruits and vegetables among small-scale farmers in Gboko Local Government area of Benue State, Nigeria. *International Journal of Innovation and Scientific Research* 19(1): 201-208.

Kulwijila, M. (2021). Socio-Economic Determinants of Post-Harvest Losses in the Grape Value Chain in Dodoma Municipality and Chamwino District,Tanzania. *African Journal of Economic Review,* 9(2): 288-305

National Bureau of Statistics (NBS) (2018). 2017 Demographic Statistics Bulletin, 26p.

National Population Commission (NPC) (2006). The New Partnership for Africa's Development Food Summit. 8-12 September, Abuja, Nigeria

Ngowi, E. R. and Selejio, O. (2019). Post-harvest loss and adoption of improved post-harvest storage technologies by smallholder maize farmers in Tanzania. *African Journal of Economic Review* 7(1): 249 - 267.

Oladimeji A. O., Olajide O. G., Abisuwa T. A. and Ayodele B.B. (2019). Post-harvest Losses: Impact on Nigeria Economy. *European Modern Studies Journal*, 3(3) :31-35p

Sablani, S.S., Opara, L.U. and Al – Balushi, K. (2006). Influence of bruising and storage temperature on vitamin C content of tomato. *Journal of Food, Agriculture and Environment* 4(1): 54 - 56.

Ukohol, F.Y. and Agbarevo, M.N.R. (2022). Assessment of Postharvest Management Practices of Vegetable Crops among Rural Farmers in Zone B Local Government Areas of Benue State, Nigeria. *Journal of College of Agricultural Economics, Extension and Science (JAEES),* 7(2): 191 - 201