WOMEN FARMERS AND POSTHARVEST LOSSES: A STUDY OF TECHNICAL AND ENVIRONMENTAL FACTORS IN TARKA LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA.

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ASTRACT

Post-harvest losses have been identified as one of the determinants and major causes of food shortage problem in Nigeria. Tomatoes and pumpkin vegetables often record great amount of produce loss which translates to waste of resources, reduction in income and welfare. This paper examined the determinants of postharvest losses of tomato and pumpkin vegetables among women farmers in Tarka Local Government Area of Benue State, Nigeria. The utility maximization theory served as the theoretical framework. Survey research design was adopted and the sample size was 279 registered women farmers/dealers. Data were generated through questionnaire. Descriptive statistics such as frequency count, mean scores, percentage and multiple regression analysis were used in data analysis. The findings revealed among others that age, farming/marketing experience, education, marital status and number of dependants were significant socio-economic factors influencing postharvest losses at ($F=31.457$; $p>.05$). Technical factors such as lack of cold storage facilities, use of wooden crates and woven baskets with sharp surfaces, lack of processing factories, vehicle heat on transit, inappropriate storage/preservative facilities, lumping of leaves, insufficient large daily markets, and environmental factors such as excessive field heat, lack of access roads to farm/market and insufficient large daily markets were found to be significant at ($F=29.054$; $p>.05$). However, the study concluded that until these influencing factors are adequately controlled and excess loss of the products curtailed, farmers' income and livelihood opportunities may not be reasonably improved. It was recommended among others that Benue State Agricultural and Rural Development Authority (BNARDA) should embark on enlightenment programme on tomato and pumpkin vegetable postharvest handling and control techniques to help reduce spoilage or losses.

Keywords: Determinants, Farmers, Postharvest Losses, Pumpkin Vegetables, Tomatoes.

Introduction

Agriculture is a major sector of the Nigeria economy, that contributes more than 30% of the total annual Gross Domestic Product (GDP), employs about 70% of the labour force, accounts for over 70% of the non-oil exports and, perhaps, most importantly, provides over 80% of the food needs of the country in a bid to ensure food sufficiency (Adegboye, 2004).

This is predicated on when everyone will have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life (FAO, 2001). However, there have been continued losses in many places due to poor and ineffective postharvest handling operations. In Nigeria, a wide range of agricultural products are being produced and mostly lost at one level or the other at postharvest stages, leading to wastage in human effort, farm inputs and investments (Olayemi, Adegbola, Bamishaiye& Awagu, 2012).

Recently, the Director of the Centre for Food Technology and Research (CEFTER), Makurdi, Benue State revealed at its 2017 '*Food Week and Exhibition*' that over 50 percent of the food crop produced in the country was lost due to poor handling (Duru, 2017). It is also believed that up to 40% of the harvested crops got lost during distribution (Olorunda, 2000). However, post harvest losses result not only in the loss of the actual crop but also losses in the environment, resources, labour in producing the crop and livelihood of individuals involved in the production and marketing processes (Adeniyi &Ayandiji, 2014).

The Food and Agricultural Organization of the United Nations estimates that globally about one-third of all the food produced is either lost or wasted before consumption (Kitinoja, Tokala & Brondy, 2018). The losses occur during harvesting, handling, processing, storage and packaging of these agricultural produce (Bolarin & Bosa, 2015). Survey carried out on post harvest losses in some communities in Nigeria revealed that as much as 20–30% of total grain production, 30–50% of root and tuber and usually high percentage of fruits and vegetables are lost with a substantial amount recorded during storage (Mijinyawa, 2002). This has been blamed hugely on inadequate storage and processing facilities (Oketola, 2016). He noted that peasant tomato and vegetable farmers in Benue state struggled through 2015 cropping season to make reasonable returns on harvest; but due to lack of preservative facilities huge fortune was lost.

In developing countries like Nigeria, vegetables like tomato and pumpkin lack adequate or proper storage, packaging, transportation and handling technologies when compared with developed economies, hence considerable amount of the produce are lost (FAO, 2005). This has serious implication on food security as it is bound to affect the affordability and availability of fresh produce to consumers. Tomato (Solanum lycopersicum) and Pumpkin (Telferia occidentalis) are two major vegetables that are tremendously popular and most

essential in Nigeria for cooking, after onion and pepper (Orebiyi, Ben-Chendo & Effiong, 2016). Notably, world tomato production as at 2001 was put at 105,000,000 metric tons of fresh fruit from an estimated 3.9 million hectares (FAO 2005). In 2008, China had the largest production capacity of fresh tomato in the World with an estimated 30,102,040 metric tons, and Egypt was the largest producer in Africa with 9,204,097 metric tons capacity. With this, Nigeria became the 13th largest producer in the world and second in Africa with an estimated 1,701,000 metric tons (FAO, 2011). On the other hand, fluted pumpkin which is virtually consumed world over is one of the most cost-effective and sustainable solution to micronutrient deficiencies, which affect far more people than hunger alone (International Plant Genetic Resources Institute - IPGRI, 2013).

Due to the increasing awareness of their enormous nutritive and medicinal benefits, as well as their expanding economic value, the domestic consumption and demand are on the increase (Joana, 2015). Particularly, the Federal Ministry of Agriculture and Rural Development put the demand for tomatoes in Nigeria at 2.2million tons and the supply at 800,000 tons; stating that out of 1.5 million tons harvested, over 700,000 tons are actually lost to post-harvest bottlenecks. Soe, (2013) argued that they are not only seasonal but highly perishable and can deteriorate few days after harvest, losing almost all their required quality attributes and could likely result to total waste due to relatively poor storage capability. Other losses occur in transit due to long distance to markets, heat, poor and inadequate infrastructures, and method or means of transportation (Mukaminega, 2008).

Evidence has shown that the production of tomato and pumpkin can improve the livelihood of small-scale producers and marketers by creating jobs and serving as source of income for both rural and peri-urban cooperative dwellers. Despite these benefits, many constraints, like post-harvest losses make their production and marketing unprofitable and wellbeing of the stakeholders less impressive (Arah, Kumah, Anku &Amaglo, 2015). The most important goal of a good post-harvest operation is to keep the product cool, thereby avoiding moisture loss and slowing down undesirable chemical changes and to avoid physical damage such as bruising and spoilage (Orebiyi, Ben-Chendo & Effiong, 2016).

Agricultural technology that enhances sustainable production of food is critical for sustainable food security and economic development. This has made the dynamics of technical change in agriculture to be an area of intense research since the early part of

twentieth century (Loevinsohn*et al*, 2013). These technologies are particularly relevant to smallholder farmers in developing countries because they are constrained in many ways, which makes them a priority for development efforts. Agricultural technologies, therefore, are those activities that aid improved agricultural production and processing (Mwangi & Kariuki, 2015). Reducing the wastage of crops after they are harvested is still in low priority for many countries in their efforts to bridge the widening gap between food production and food requirement (Thomas, 2013). He argued that research conducted worldwide in the past four decades have shown that radiation processing is an effective and safe method for several commercial applications, e.g. controlling insect infestation in grains and other stored food products, delaying the ripening of fruits and preventing sprouting in bulb and tuber crops.It is against this background that this paper examines the determinants of postharvest losses of tomato and pumpkin vegetables among women farmers in Tarka Local Government Area of Benue State, Nigeria.

Statement of the Problem

There are many challenges facing small scale farmers especially in developing countries that usually lead to post-harvest losses. Amongst these are inadequate storage and processing facilities, rodents, insects, fungai and birds etc. It was predicted that the world's population will increase to about 9.1 billion people by the year 2050 and bulk of this increase is expected to occur in developing countries, which Nigeria is among. Hence, the need for much investment in the agricultural sector is necessary in order to produce more food with improved storage and processing facilities that will help reduce post-harvest losses (Yusuf & He, 2011).

Agricultural losses, especially along the post-harvest food supply chain have been identified as one of the determinants and major causes of food shortage problem in Nigeria and Benue in particular (Babalola, Makinde, Omonona&Oyekanmi, 2010). Vegetable farmers such as those that grow tomatoes and pumpkin often record great amount of produce loss which translates to waste of resources, reduction in income and ultimately welfare (Adepoju, 2014).

In Benue, proper post-harvest storage, packaging, transport and handling technologies are practically insufficient for perishable crops, thereby allowing for considerable loss of this produce. Improper post-harvest sanitation, disease infestation and mechanical damages

during harvesting, bruises resulting from vibration by undulation and irregularities on the road also enhance wastages (Idah, Ajisegiri& Yisa, 2007).

It is estimated that an alarming 45 percent of tomatoes and pumpkin harvested in the country are lost due to poor Food Supply Chain (FSC) management; price instability resulting from seasonal fluctuation in production, poor packaging, long distance to market, poor storage and method of transportation. According to the Horticulture Transformation Tomato Value Chain Implementation Action Plan of the Federal Government (2012-2015), this loss comes to about 750,000 metric tons, amounting to great loss in millions of naira. This is despite the fact that the country has not been able to meet domestic demand for tomatoes. In fact, between 2009 and 2010, Nigeria imported a total of 105,000 metric tons of tomato paste valued at over N1.6 Billion to bridge the deficit gap between supply and demand in the country (Joana, 2015). This huge sum can be classified as a waste of scarce resources considering the fact that the nation has large green vegetation, especially in Tarka, Benue state for tomato and pumpkin cultivation.

Benue appears to be lacking many post-harvest preservative facilities, thus, making farmers efforts to amount to wastage and losses (Oketola, 2016). He noted that peasant tomato and vegetable farmers abandoned their produce in various markets in the state due to poor pricing and inability to preserve due to the non-existence of storage and processing facilities. It is in view of the aforementioned issues and the fact that such study has not been conducted in the area that this paper examines the determinants of postharvest losses of tomato and pumpkin vegetables among women farmers in Tarka Local Government Area of Benue State, Nigeria.

Objectives of the Study

The broad objective of this paper is to examine the determinants of postharvest losses of tomato and pumpkin vegetables among women farmers in Tarka Local Government Area of Benue State, Nigeria. The specific objectives try to;

1. Determine technical and environmental factors influencing postharvest losses in tomato and pumpkin vegetables among women farmers in Tarka LGA, Benue State.

Research Hypotheses

Technical and environmental factors have no significant influence on postharvest losses of tomato and pumpkin vegetables.

Literature Review

The Concept of Postharvest Losses

Farmers and food sellers have been concerned about losses since agriculture began. Yet the problem of how much food loss after harvest to processing, spoilage, insects and rodents, or to other factors takes on greater importance as world food demand grows. Cutting postharvest losses could presumably add a sizable quantity to the global food supply, thus reducing the need to intensify production in the future (Kiaya, 2014).

Bolarin & Bosa (2015) describes post-harvest losses as the agricultural wastages at harvest, processing and handling stages. On the other hand, post-harvest loss can be defined as the degradation in both quantity and quality of a food production from harvest to consumption (Kiaya, 2014). He argues that quality losses include those that affect the nutrient/caloric composition, the acceptability, and the edibility of a given product. These losses are generally more common in developed countries (Kader, 2002). Quantity losses refer to those that result in the loss of the amount of a product. Loss of quantity is more common in developing countries (Kitinoja and Gorny, 2010). A recent FAO report indicates that at global level, volumes of lost and wasted food in high income regions are higher in downstream phases of the food chain, but just the opposite in low-income regions where more food is lost and wasted in upstream phases (FAO, 2013).

Crop losses, especially along the post-harvest food supply chain, have been identified as one of the major causes of food shortage problems in most developing countries and Nigeria in particular. Post-harvest losses is said to be making Nigerian farmers poorer and they have lamented the situation without getting meaningful assistance (Ahmed, 2013; Mada, Hussaini, Medugu& Adams, 2014). Vegetable farmers such as those that grow tomatoes often record great amount of produce loss which translates to a waste of resources, reduction in their income and ultimately their welfare (Adepoju, 2014). Poor post-harvest handling of perishable farm produce by the farmers can be traced to the negligence on the part of some farmers when rotten fruits are mixed with healthy ones. This tends to have a multiplying effect of rot on the healthy fruits. Also, fruits and vegetables which include tomatoes produced in rural areas are hardly taken to the market either due to lack of access to nearby markets or inadequate market information by these farmers. Since the farmers have little or

no capacity to process their produce and coupled with the fact that there are no modern storage facilities, their products are prone to damages and post-harvest losses (Kader, 2005).

Tomato and Pumpkin Vegetables

Tomato and pumpkin are two important vegetables that are widely eaten and used for many delicacies or purposes, especially in Nigeria. As economical and nutritional important as these vegetables are, they are highly perishable and best used while green and red. This tends to prevent adequate supply and accessibility to these agricultural produce when fresh, thereby causing an increase in the price (Mbuk, Bassey, Udoh & Udoh, 2011).In Nigeria, tomato is cultivated in most Northern States such as Jigawa, Katsina, Zamfara, Sokoto, Benue, Kaduna, Bauchi, Gombe and Taraba. Interestingly, Benue and Kano are amongst the leading states that cultivate this vegetable in commercial quantity (Shankara et al., 2005). This is due to the dry season cultivation of over 30,000 hectares of irrigated tomatoes in the areas.

Aside from being tasty, tomato promotes healthy nutritional balance as it is a good source of vitamins A and C (Ascorbic Acid which aids the healing of wound, strengthening of blood vessel walls, etc.). One medium sized tomato provides 57% of the Recommended Daily Allotment (RDA) of Vitamin C, 25% RDA of Vitamin A and 8% RDA of Iron, yet it has only 35 calories (Joana, 2015). It is also an excellent source of Lycopene (a very powerful antioxidant) that helps to prevent carcinogenic cell growth. It is considered as an important cash and industrial crop in many parts of the world (Babalola et al., 2010). Although tomatoe has numerous benefits and can improve the livelihoods of farmers, studies have shown that the full potential of the crop has been under exploited because of many challenges which include postharvest losses (Arah, Kumah, Anku &Amaglo (2015).

However, pumpkin is a resilient traditional crop that adapts to diverse climatic conditions and rich in various nutrients. Its production could contribute to improved household food security and livelihoods (Ndegwa, 2016). Fluted pumpkin is a most important and extensively cultivated food and income generating crop in many parts of Africa (Adebisi-Adelani, Olajide-Taiwo, Adeoye &Olajide-Taiwo, 2011). According to Mohammed in Abu and Asember (2011), it can give high yield per unit area of land and hence generate high income for the farmers and marketers.

Technical Factors Influencing Loss in Tomato and Pumpkin Vegetables

The choice of technical or technological post-harvest loss preventive package depends on circumstances such as the scale of production, crop type and the farmers' affordability and willingness to pay (Kiaya, 2014). He linked these to social, cultural and economic implications of adoption.

Tomatoes are harvested by manual picking instead of mechanically in most developing countries. The majority of farmers from Africa use wooden crates and woven baskets with hard and sharp surfaces which cause injuries to the harvested tomatoes. People in developing countries often cannot afford the use of cold storage facilities for their preservation, which may be due to lack of capital or technical knowledge by small scale growers and retailers in these areas as well as poor or inadequate power supply (Thirupathi, Sasikala & John, 2006).

Post harvest system or technical engineering deals with threshing, shelling and processing with machine required to accomplish the stages of operation of finish consumer's goods. It involves cleaning, cooling, size reduction and other processing operations. The produce has to be conveyed from one point to another, especially in processing industries. These multipurpose machines are relatively scarce in many places, especially rural areas (Mada, Hussaini, Medugu& Adams, 2014). This is often as a result of lack of proper awareness, inadequate fund, poor level of education and other factors. Kiaya (2014) argues that poor or ineffective transportation system is a notable technical factor that leads to postharvest losses in tomato and other perishable vegetables. He stressed that much care is needed in transporting a really mature harvest, in order to prevent falling on the road before reaching the storage or threshing point. Aidoo *et al* (2014) observes that inappropriate storage facilities and rough handling during harvesting result in bruising and increased possibilities of contact of the produce with soil which leads to contamination with organisms. Mbuk, Bassey, Udoh & Udoh (2011) submits that number of times of washing and method of overnight storage influences tomato losses.

Environmental Factors Influencing Loss in Tomato and Pumpkin Vegetables

Environmentally, numerous factors appear to affect or lead to loss of many fruits and vegetables. It is often as a result of prevailing climatic conditions, soil texture, heat etc (Kiaya, 2014). This suggests that they could be controlled or even difficult due to poor training or lack of requisite technology to do so.

Arah et al (2015) reports that postharvest losses of tomato could involve on-farm and off-farm. They identified the on-farm losses to include improper harvesting stages, excessive field heat, improper harvesting containers, poor farm sanitation and improper packaging materials. On the other hand, the off-farm losses comprise lack of access roads, inappropriate transportation system and lack of processing factories. While farmers in developed world have access to commercial forced-air cooling system, their counterparts in developing countries do not have the capacity to install such technologies in their farms and have therefore improvised other cooling systems. Although some farmers in developing countries are already using low-cost on-farm cooling systems in the form of structures, they form a small proportion (less than 10%) of the number of tomato producers especially in Africa (Olayemi, Adegbola, Bamishaiye& Daura, 2010).

Market availability is a big challenge facing most tomato and pumpkin producers in developing countries especially those in Africa (Arah *et al,* 2015). They stressed that many of such markets are on interval basis and not daily which could boost sales. This is the unfortunate reality in many markets in Benue state, where tomatoes that seems to soften are usually seen poured or abandoned. This could be as a result of heat and unfinished sales, which ought to have been taken to technological cooling system for preservation. Due to lack of such facilities they are usually wasted. This situation is not far from what is at times witness of pumpkin leaves. Vegetables that are ought to be taken green and fresh are usually dried by heat, dark and perhaps lost needed nutrient. When left unpatronized by buyers, the dealers would be left with no option than to abandon them in the markets out of frustration.

Theoretical Framework: Utility Maximization Theory

The utility maximization theory posits that producers maximize utility against constraints in production resources. It is on the premise that farm households were rational in using production resources and choosing the market that maximized their utility (Ndegwa, 2016). In other words, when there are losses like that of the post-harvest it affects or diminishes the profit maximization of the women farmers.

The main objective of producing or selling agricultural commodities by farm households or traders is to maximize profit. In this study it is assumed that tomato and pumpkin farmers or traders' participation in the venture were influenced by perceived utility value or net benefit

from the commodities. However, the farming or marketing activities could also be influenced by the socio-economic factors of the farmers or dealers and market characteristics.

Research Method

The paper adopts survey research design and questionnaire served as the major instrument of data collection.This study was conducted in Tarka LGA of Benue State, Nigeria. The headquarters is in the town of Wannune. The area has a land mass of about 60,000 sq.km and a population of 79,494 persons (National Population Commission, 2006). Tarka shares boundaries with Guma to the North; Gwer to the West; Buuku to the East and Gboko to the South (Encyclopedia, 2018). Tarka is well known for farming and the level lands and guinea savanna vegetation favours root, vegetables and grain crops simultaneously (Ezihe, Agbugba&Iornum, 2014). Farming is the major occupation of Tarka indigenes, especially the women. Many of those women are illiterates and post-harvest losses often mare their agricultural efforts (BNARDA, 2015).

The population was nine hundred and twenty-three (923) registered pumpkin vegetable and tomato cooperative farmers/dealers. This is comprised of 497 farmers and 426 dealers (Agricultural Unit of Tarka LGA, 2017). The sample size was two hundred and seventy-five (275) women farmers/dealers in Tarka LGA. This was statistically generated using Taro Yamane (1967) formula. The Bowley's proportional allocation formula was used to select respondents. Data were analysed using frequency count, mean scores, percentage and multiple regression.

Results and Discussion

Total questionnaires distributed 275, while 248 were retrieved successfully.

Demographic Data of the Respondents

Table 1: Analysis of Demographic Data of Respondents

S/n	***Variables***	***n=248***	***%=100***	***x***
1	**Respondents**			
	Pumpkin	121	48.8	
	Tomatoes	127	51.2	
2.	**Age (Yrs.)**			
	18-28	7	2.8	
	29-39	98	39.5	
	40-50	122	49.2	41
	51 & Above	21	8.5	
3.	**Farming/Marketing Experience (Yrs.)**			

	Below 4	10	4.0	
	5-10	34	13.7	
	11-16	125	50.4	14
	17-22	62	25.0	
	23 & Above	17	6.9	
4.	**Educational Qualification**			
	No formal Education	41	16.5	
	Koranic	13	5.2	
	Primary	109	44.0	
	Secondary	58	23.4	
	Vocational/Technical	21	8.5	
	Tertiary	6	2.4	
5.	**Marital Status**			
	Married	101	40.7	
	Single	16	6.5	
	Widow	120	48.4	
	Divorced/Separated	11	4.4	
6.	**Income in 2017**			
	Less than N50, 000	69	27.8	
	N50, 001 – N100, 000	35	14.1	
	N100, 001 – N150, 000	132	53.2	93,932
	N150, 001 & Above	12	4.9	
7.	**Savings in 2017**			
	Below N20, 000	60	24.2	
	N20, 001 – N50, 000	51	20.6	47,541
	N50, 001 – N80, 000	129	52.0	
	N80, 001 and Above	8	3.2	
8.	**Number of Dependents**			
	0 – 3	28	11.3	
	4 – 7	23	9.3	
	8 – 11	141	56.9	10
	12 & Above	56	22.5	

Field Data, 2018

Table 1 presents the analysis and result of the demographic information of the respondents. It is clear from the table that majority (51.2%) of the respondents are tomato farmers/dealers, while 48.8% are their pumpkin vegetable counterparts. This indicates that there are more tomato women respondents than those of pumpkin vegetables. The average age mean of the respondents was 41-years, implying that active working age groups are into tomato and pumpkin vegetable farming and marketing, thus, boosting production. Their average farming and marketing experience was found to be 14-years. Having had these reasonable years of farming and marketing experiences, suggests possible rewarding economic returns and also indicates that the women are committed. However, the highest number of the respondents (44.0%) has primary education and this was followed by 16.5% that never had formal education. This suggests that the women have not received sufficient formal education and

could affect their business and farming approach. This agrees with the findings of Ayandiji in Adepoju (2014) who discovered that only 2.2% of citrus and tomato farmers in Ife, Osun State had tertiary education. Notwithstanding, about 48.4% and 40.7% are widows and married respectively; suggesting that they could be mothers with dependants and much more responsibilities to carter for. This may often affect their ventures as many Nigerian mothers would always ensure that their families are comfortable, especially on what to eat for the day before embarking on other things. Thus, their farms or businesses often come as secondary issue in their daily program. On the average, majority of the respondents had N93,932 and N47,541 income and savings in 2017 respectively. Therefore, it can be inferred from the figure that on average the farmers are poor and managing. The rationale behind these poor income and savings may not be far from effect of the postharvest losses and other needs, such as the average 10 dependants on them. This number of dependants may be perceived or serve as source of labour supply, while at the same time increase consumption rate which could possibly take the little savings (Babalola &Agbola, 2008); thus, leaving the women with little or none to reinvest or acquire techniques that could help control some of the factors necessitating losses.

Socio-Economic Determinants of Losses inTomato and Pumpkin Vegetables

Table 2: Regression result on socio-economic determinants

	Coeff.	*t-value*	*Sig.*
Constant	327.214	3.154	0.000
X_1 Age	-1.016	-0.367*	0.201
X_2 Farming/marketing experience	204.193	3.008*	0.000
X_3 Education	05.207	2.490*	0.012
X_4 Marital status	426.016	2.013*	0.010
X_5 Income	2.005	0.828	0.031
X_6 Savings	-035.117	-0.019	0.180
X_7 Number of dependants	203.012	437.006*	0.000
R^2		0.837	
Adj. R^2		0.624	
F		31.457	
N		248	

Field Data, 2018; *Significant at 5% level; Dependent Variable: Postharvest losses

Table 2 presents that analysis of objective one on the socio-economic factors influencing postharvest losses in tomato and pumpkin production among the women farmers in Tarka. A cursory look at the table reveals that all the variables have positive coefficient significance in influencing the postharvest losses except savings and age. This point that it may not

necessarily be savings issue that impedes the control of postharvest losses, but influences of other factors. Beside, farming/marketing experience and level of education acquired are coefficiantly significance. This infers that the more years or well educated a farmer/marketer spend or knowledge acquired, the more control she may exercise over some controllable postharvest losses; while reverse may be the case when there is less experience and less education. The findings supports that of Edet, Jim, Uwemedimo& Edet (2015) that farming experience, household size, age of farmers, farm size etc determines pumpkin production output and losses in Akwa Ibom State. Also, marital status, income and number of dependants are statistically significance in influencing postharvest losses in tomato and pumpkin vegetables. This suggest that short of income could militate against the possibility of saving adequately to be able to acquire requisite managerial knowledge or even buying of improved technologies and processing facilities that would aid reduction in losses. This align with Nwosu, Onyeneke& Okoli (2012) that found household size, farming experience, marital status etc as having positive significant influence on fluted pumpkin production in Ezinihitte-Mbaise, Imo State.

Test of Hypothesis One

$\square_{\square_{\square}}$: Socio-economic profile of women farmers have no significant influence on postharvest losses in tomato and pumpkin.

Table 3: Regression Model Summary of Hypothesis One

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig.
1	.956[a]	.837	.624	13.69857	.837	31.457	7	240	.000[a]

a. Predictors: (Constant), age, farming/marketing exp., education, marital status, income, savings, dependants

b. Dependent Variable: postharvest losses

Field Data, 2018; P-value = .000, which is less than < 0.05 level of significance.

The result of table 3 indicates that R^2 is 0.837, which indicates the extent which dependent variable is explained by independent variables. That is, 84% of variation in dependent variable (postharvest losses) are caused or explained by the independent variables (such as age, farming/marketing experience, education, marital status, income, savings and number of

dependants). Again the adjusted R^2 is .624, implying that 62% of postharvest losses was explained by changes in the socio-economic profile of the women farmers. However, the coefficient result of the regression as shown in table 5 reveals that all the socio-economic variables were significant factors influencing postharvest losses at 5% level and with p-values less than 0.05, except income and savings that were not. Thus, the study rejects the null hypothesis and accept the alternate, implying that the socio-economic profile of women farmers have significant influence on postharvest losses in tomato and pumpkin in Tarka LGA. The result agrees with the submission of Edet et al (2015) that socio-economic background of pumpkin farmers determines there produce and possible losses.

4.4 Technical and Environmental Factors Influencing Losses in Tomato and Pumpkin

Table 4: Regression result for tomato

	Coeff.	*t-value*	*Sig.*
Constant	547.223	2.034	0.001
X_1 Lack of cold storage facilities	03.105	06.122*	0.000
X_2 Inappropriate storage facilities	846.013	2.016*	0.002
X_3 Poor/outdated processing facilities	114.105	1.034*	0.010
X_4 Improper harvesting containers	039.383	1.423*	0.000
X_5 Improper packaging materials	-0.331	-2.105	0.484
X_6 Use of wooden crates/woven baskets	021.221	1.732*	0.053
X_7 Lack of processing factories	012.012	322.38*	0.003
X_8 Poor transportation	13.041	04.374*	0.000
X_9 Poor harvesting technique	-2.368	-1.036	0.201
X_{10} Excessive field heat	04.900	0.127*	0.000
X_{11} Covering with polytene to keep away flies	16.830	01.392*	0.004
X_{12} Poor farm sanitation	-52.032	-02.020	0.628
X_{13} Lack of access roads to farm/market	72.370	28.111*	0.000
X_{14} Insufficient large daily markets	02.016	0.539*	0.027
R^2		0.713	
Adj. R^2		0.632	
F		29.054	
N		127	

Field Data, 2018; *Significant at 5% level: Dependent Variable: Postharvest losses

Table 4 shows regression result of the technical and environmental factors influencing postharvest losses of tomato. It can be deduced from the table that there are about eleven significance coefficient factors influencing the losses. The technical factors found to be significant include lack of cold storage facilities, inappropriate storage facilities, poor/outdated processing facilities, improper harvesting containers, use of wooden crates and woven baskets with sharp surfaces that punch the fruits, lack of processing factories and poor

transportation. Conversely, improper packaging materials and poor harvesting technique show negative signs, implying insignificant to technical factors leading to postharvest loss of tomato. These findings align with Arah, Kumah, Anku &Amaglo (2015) that found that off-farm losses in tomato to include lack of access roads, inappropriate transportation system and lack of processing factories. It also corroborates Thirupathi, Sasikala & John (2006) that majority of farmers in Africa use wooden crates and woven baskets with hard and sharp surfaces which cause injuries to harvested tomatoes. However, the environmental factors found to influence loss of tomato comprise of excessive field heat, covering to keep away flies, lack of access roads to farm/market and insufficient large daily markets. This is not surprising as the area has no daily market, but five and three day interval markets such as Wannune, Tiortyu, Tarhembe and Asukunya. Considering these number of days interval on a perishable fruit like tomatoes, there would definitely be losses. Contrarily, poor farm sanitation was found to be insignificant environmental factor that influence postharvest loss of tomatoes. This finding disagrees with Arah et al (2015) report that postharvest losses of tomatoes could involve on-farm losses such as poor farm sanitation, improper harvesting stages etc.

Table 5: Regression result for pumpkin

	Coeff.	*t-value*	*Sig.*
Constant	403.012	1.429	0.000
X_1 Lack of packaging/handling techniques	302.381	1.062*	0.000
X_2 Vehicle heat on transit	011.05	1.801*	0.010
X_3 Inappropriate storage/preservative facilities	12.419	2.042*	0.000
X_4 Lumping of leaves	03.321	33.103*	0.004
X_5 Inappropriate transportation system	-0.529	-0.183	0.901
X_6 Improper packaging materials	2.893	0.541*	0.016
X_7 Poor transportation	-1.182	-0.001	0.202
X_8 Excessive heat	111.09	4.036	0.000
X_9 Lack of access roads	34.200	0.932	0.003
X_{10} Insufficient large daily markets	20.372	6.107	0.000
X_{11} Non-market availability	-1.023	-0.041	0.460
X_{12} Poor/dilapidated road networks to markets	22.478	1.260	0.000
X_{13} Inadequate market space	0.932	0.478	0.032
R^2		0. 692	
Adj. R^2		0. 572	
F		16.471	
N		121	

Field Data, 2018; *Significant at 5% level: Dependent Variable: Postharvest losses

Table 5 displays the regression analysis of the respondents on the technical and environmental factors influencing pumpkin postharvest losses. Out of the seven technical factors, five are seen to be coefficiently significance. They are lack of packaging/handling techniques, vehicle heat on transit, inappropriate storage/preservative facilities, lumping of leaves, and improper packaging materials. However, inappropriate transportation system and poor transportation were found not to be significance. This suggests that means of transporting the vegetables were not source of major loss to the women, but other technical factors. Away from technical factors, five environmental factors were found to contribute to postharvest losses of the pumpkin vegetables. They comprise of excessive heat, lack of access roads, insufficient large daily markets, poor/dilapidated road networks to markets and inadequate market space. However, non-market availability shows to be insignificant. This corroborates the finding on the part of tomatoes farmers and dealers, implying that there are markets, but not daily ones that could boast daily and continued patronage. The findings validates that of Arah et al (2015) which noted that market availability is a big challenge facing most pumpkin producers in Africa, as many of such markets are on interval basis and not daily which could boost sales.

Test of Hypothesis Two

$\square_{\square_{\square}}$: Technical and environmental factors have no significant influence on postharvest losses in tomato and pumpkin.

Table 6: Regression Model Summary of Hypothesis Two

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig.
1	.956[a]	.971	.832	24.82693	.971	29.054	7	240	.000[a]

a. Predictors: (Constant), environmental and technical factors

b. Dependent Variable: postharvest losses

Field Data, 2018; P-value = .000, which is less than < 0.05 level of significance.

Table 6 displays the model summary of the regression on hypothesis two. The R^2 = 0.971 indicates the extent which dependent variable is explained by independent variables. That is, 84% of variation in dependent variable (postharvest losses) are caused or explained by the independent variables (technical and environmental factors). This is as the adjusted R^2 = .832,

implies that 83% of postharvest losses was caused by influences of the technical and environmental factors. However, the coefficient result points that vast majority of the technical and environmental factors significantly influence postharvest losses at 5% level, with p-values less than 0.05, except X_5, X_9, X_{12}, and X_5, X_7,, X_{11} under tomato and pumpkin vegetables that were not, respectively. Thus, the study rejects the null hypothesis and accepted the alternative, implying that technical and environmental factors have significant influence on postharvest losses in tomato and pumpkin in Tarka LGA.

Conclusion and Recommendations

This paper submits that there is prevalence of postharvest losses among women farmers and dealers in tomato and pumpkin vegetables in Tarka LGA. This is not only as a result of socio-economic characteristics, but also the influences of some controllable technical and environmental factors. To this end itwas concluded that until these influencing factors are adequately controlled and excess loss of the products curtailed, farmers' income and livelihood opportunities may not be reasonably improved. Therefore, it recommends that;

1. The Benue State Agricultural and Rural Development Authority (BNARDA) should embark on enlightenment programme on tomato and pumpkin vegetable postharvest handling and control techniques to help reduce spoilage or losses.
2. Government should intensify her efforts in road rehabilitation and maintenance across the State, especially in agricultural communities to help boast production and accessibility. This will help enhance the agricultural programmes of the federal government.
3. With the federal government commitment to agricultural production, there should be provision of preservative and processing facilities that will help minimize losses and increase income of the women.

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