FACTORS INFLUENCING POST HARVEST LOSS OF TOMATOE IN URBAN MARKET IN UYO, NIGERIA

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ABSTRACT

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This paper examines the extent of post harvest loss of tomatoe and factors that influence it. Employing panel data obtained from retailers of tomatoe in the major daily urban market (Akpan Andem market) in Uyo, Akwa Ibom State, Nigeria, findings from descriptive analysis revealed that over half of the quantity of tomatoe were already spoilt on purchase due to conditions the produce were subjected to en-route the market. Tobit regression analysis also revealed that all management practises employed by retailers in the market to reduce loss, increased the probability of spoilage except for the practise of covering the tomatoe on the table with paper (exposing the produce to air was not included in the regression. Other sources of income and the number of times produce were cleaned weekly were found to significantly influence the extent of spoilage experienced by retailers.

Keywords: Postharvest loss, tomatoes, retailers, urban market

INTRODUCTION

The marketing of farm produce in Nigeria is affected by numerous problems in addition to certain features of farming that together are unique to the indusstry (Ebong, 2000).These include the seasonality of production, which subjects a country's production to changes based on irrigation facilities; the perishability of the product, which is very high for fruits and vegetables; the bulkiness of the product, which adds to transportation inconveniences, storage and labour cost; the quality of the products such as colour,freshness, smell e.t.c. As a result of these special characteristics, the postharvest activities of these commodities must be managed properly as crops begin to deteriorate the instant they are removed from the ground (Bourne,1983).In Agriculture, postharvest handling is the stage of crop production immediately following harvest. It includes storage,cleaning, packing, transportation and sorting (Mrema and Rolle, 2002). The most important goals of postharvest handling are to keep the product cool, thereby avoiding moisture loss and slowing down undesirable chemical changes and to avoid physical damage such as bruising to delay spoliage. This in turn will help ensure increased food security as food security goes beyond food production to include distribution and marketing, adequate and stable supply, and accessibility to food. Usually, losses occur from poor storage conditions in the markets and poor packaging during transportation. Due to the physiological form of fruits and vegetables, they detoriorate easily in transit and storage, especially under conditions of high temperature and humidity and as a result, heavy losses occur in these crops (Idah *et al*, 2007). Their physiological form encourages increased pace of metabolic activities, which is quickened by higher temperatures prevalent in tropical countries. Respiration brings about loss of considerable quantity of the main nutritional ingredient- ascorbic acid in vegetables. Mukaminega (2008) further suggests that losses of fruits and vegetables also occur in transit due to long distance to markets, poor and inadequate infrastructures, and the method of transportation. According to FAO (2004), in developing countries postharvest losses of fruits and vegetables are more serious than those in well developed countries. In most developing countries the number of scientists concerned with postharvest handling research are significantly lower than those involved in production research. The handling procedures used in technolgically advanced countries to reduce post harvest losses are not fully recognised in less developed countries. FAO (2004), further suggests that in developing countries, for perishable crops like fruits and vegetables, storage, packaging, transporting and handling technologies are practically non-existent, hence considerable amount of produce are lost. Tyler and Gilman (1979) outlines the multiple effect of post harvest loss as going beyond the loss of the actual crop to include loss in the environment, resources, labour needed to produce the crop and livelihood of the individuals involved in the production process.

Post harvest loss tends to prevent adequate supply of and accessibility to fresh agricultural produce, thereby causing an increase in the price of such produce. In Nigeria, where most of the fruit vegetables, like tomatoe, are grown commercially in the Northern part, loss in transit occurs–especially en route to southern markets, due to its physiological nature (high moisture content, high respiration rate and soft texture) which subjects it to microbial, mechanical and physiological damages (Karim and Hawlader, 2006) among other factors, yet the extent of this

loss is not known. Also, the extent of loss that occurs among retailers within the markets due to lack of appropriate storage facilities and the effectiveness of the various methods they employ to reduce the loss is uncertain as there is a dearth of data in this regard. Evaluation of the extent and nature of post harvest loss as in the case of this is important. This is because in tackling food security, it becomes important to know the effectiveness of post harvest management practices adopted by marketers, especially for developing countries like Nigeria, where post harvest storage, packaging, transporting and handling technologies are practically non-existent for perishable crops like fruits and vegetables. This paper, therefore, seeks to, evaluate the extent and nature of postharvest loss of tomatoes, and determine the factors that influence this loss in Akpan Andem Market-the major daily market in Uyo metropolis the capital of AkwaIbom State, Nigeria.

METHODOLOGY

Data collection procedure

This study utilized panel data that were collected from experienced tomatoe retailers in Akpan Andem Market-Uyo, Akwa Ibom state. This market serves as the central disposing unit for fruit vegetables in the Uyo urban that are brought in from the northern part of the country. Sixty (60) retailers were randomly selected from two hundred (200) retailers that constitute the population of tomatoes retailers operating in the market. From this sixty (60) respondents, the required data such as socio-economic profile, quantities purchased, quantities spoilt (on purchase and before the next purchase), and the different types of loss,etc were observed, measured and collected four (4) days every week for one (1) month. Two (2) of this four (4) days were days when retailers purchased the produce (i.e. days when the produce arrived in the market), while the other two (2) days were the days before the next purchase.

The categories for the different types of loss relevant to this study was adopted from Bourne (1984) and modified as follows:

Categories	Features	Primary Causes	Secondary Causes
Biological	Black scars, bites and holes	Damaged by insects, mites, rodents, birds and larger animals.	Poor Storage Condition
Microbiological	Appearance of whitish substance and rotting	Damaged by microbes such as molds, bacteria and yeast.	Biological Damage
Chemical and Biochemical	Appearance of whitish substance and rotting	Damaged by undesirable reaction between chemical compounds that are present in the food/ foodstuff, such as from mallard reaction, fat oxidation and enzyme acttivated reactions.	Time lag between harvest and consumption
Mechanical	Bruises, peeling, soft, and burst produce.	Damaged by abrasion, spillage, bruising, excessive pollishing, peeling or trimming, heat.	Harveting, Poor transportation system, Overloading of Produce, Packaging, Sorting, Poor Management practices.

For this study, microbiological and chemical/ biochemical will be categorized as other causes.

Method of data analysis

A combination of analytical techniques was used to analyse the data obtained. These include descriptive statistics and the Tobit regression model.

The desciptive statistics included frequency, percentages and means and was used to categorise tomato retailers under socioeconomic characteristics, to show the extent of tomato spoilage, to categorise the spoilage under the different types and to describe the various manaagement practices employed to reduce the loss.

The Tobit regression model a hybrid of the discrete and continuous models, was used to determine the impact of the explanatory variables on the probability of spoilage of tomatoes. This model was adopted by Udoh and Omonona (2008), in the study of adoption of improved rice varieties to show the extent and intensity of adoption. The choice of the model, as against the probit or logit model, was based on the fact that with it,the intensity of loss as it relates to each independent variable can be determined.

Specification for the determinants of spoilage is:

$$Y_i = y_i = \beta X_i + \mu \quad \text{if } y_i > 0$$
$$0 = \beta X_i + \mu \quad \text{if } y_i < 0$$

i = 1, 2,3,...60 tomato retailers. Y_i is the dependent variable.It is discrete when tomato is not spoilt and continuous if spoilt.Y_i^* is the level of spoilage defined as a/A; where 'a' is the total quantity of spoilt tomatoes and 'A' is the total quantity of tomatoes purchased by retailers. $y_i^* > 0$ implies that y_i^* is observed whereas the reverse is the case when . $y_i^* < 0$. X_i is a vector of explanatory variables, β is a vector of unknown coefficients and μ_i is an independently distributed error term. The independent variables specified as determinants of spoilage are defined as follows; X_1 = Age (years), X_2 = Education of tomato retailers (years), X_3 = Income from tomatoes (₦), X_4 =Income from other sources (₦), X_5 = Experience (years), X_6 = number of times of purchase (days in a week), X_7 = quantity per purchase (kg), X_8 = days to finish selling (days in a week), X_9 = number of times of cleaning (days in a week), X_{10} = method of washing (dummy: 1=wash everything,0= wash only spoilt),X_{11} = number of times of washing (days in a week),X_{12} = method of storage (dummy).

RESULTS AND DISCUSSION

Socioeconomic characteristics

Most of the tomato retailers (98.3 %) are females affirming the study by Adekanye (1998),which revealed that women dominate foodstuff marketing. This suggests that when postharvest loss occurs the livelihood of women is mostly affected. Majority of the respondents (56.7%) have attained primary school, with the mean number of years spent in school being 5 showing that the tomato retailers can at least read and write.Tomato retailers within the 21-40year age group constitute 66.7% of respondents followed by the 41-60 year age group which constitute 16% indicating that most tomato retailers are within the working and productive age. More than half (63 .3%) have between 1 and 6 years experience of selling tomatoes.The average years of experience of selling tomato is 6 years. Almost all (96.7%) of the respondents are selling tomatoes as their primary occupation which suggests that tomato retailing is likely a lucrative means of livelihood. The average monthly income earned by respondents is ₦71,000, confirming that the sale of tomato is lucrative.

Table 1: Distribution of retailers by socio-economic characteristics

Characteristics	Frequency	Percentage
Sex		
Male	1	1.7
Female	59	98.3
Years of formal education		
None	16	26.7
1 – 6	34	56.7
7 – 12	10	16.7
Mean Value = (6)		
Age		
≤ 20	4	6.7
21 – 40	40	66.7
41 – 60	16	26.7
Mean Value = (36)		
Experience		
≤ 6	38	63.3
7 – 11	14	23.3
12 – 16	7	11.7
≥ 16	1	2.1
Mean Value = (6)		
Household size		
1 – 3	14	23.3
4 – 6	38	63.3
7 – 9	8	13.3
Mean Value = (5)		
Monthly income from tomatoe		
≤ 50,000		
51,000 – 80,000	17	28.3
81,000 – 110,000	19	31.7
≥111,000	12	20.0
Mean Value = (71960)	12	20.0
Sale of tomatoe as primary occupation	58	96.7
Yes	2	16.7
No		

Source: Field Survey, 2010

Extent of loss

Table 2, shows that on purchase, the quantity of spoilt tomatoe is over 50%. This is in line with the study of Watkins and Anubha (2007), which observed that postharvest food loss can reach up to 50% of total food production.The level of postharvest loss observed on purchase could be traced to overheating during transportation as Kader(2005) explained that overheating during transportation of fruits and vegetables leads to decay and increases the rate of water loss. Before the next purchase, about 51.3% of left over produce was spoilt. This could be as a result of time lag and place of storage.This is consisitent with FAO(2004),which suggests that fruits and vegetables are also susceptible to contaminanats from place of storage. Kader(2005) also suggests that as the time the produce stays in the market increase from the time of purchase, its deterioration also increases. Refering to Bourne (1983) and his classification of the causes of post harvest loss, Table 2 further shows that the type of spoilage observed on purchase could only be traced to mechanical causes –33.5% comprised of soft tomatoes and burst tomatoes 18.10%. This could have resulted from careless handling during loading and offloading, overheating as packages are often squeezed into vehicles and vehicles are sometimes closed and void of ventilation. According to FAO(2004), damage also occurs as a result of careless handling of packed produce, with packages often squeezed into the vehicle in order to maximize revenue for transporters.

Before going on the next purchase, 16.7% of spoilt tomatoes from the left over produce was traced to mechanical causes, 8.6% to biological causes and 35.9% were spoilt by other causes (rotten tomatoes; here the cause of spoilage could not be ascertained and could be as a result of aggravated mechanical damage, biological or chemical/biochemical, or a combination of two or all of them). This affirms the fact that biological, microbiological, chemical and biochemical causes of loss are primarily due to the place and method of storage, and the time lag between purchase and selling as suggested by Bourne (1983). Furthermore, the high level of spoilage of left over produce and produce on purchase shows how poor the management practices/ tehnologies employed to curb loss are or thier non-existence as suggested by FAO(2004).

Table 2: Extent of spoilage from mechanical, biological and other sources

Period		Average quantity/ purchase(kg)	Percent
On	Spoilage from mechanical damage		
purchase	Soft tomatoes	41.71	33.50
	Burst tomatoes	22.58	18.10
	Total spoilt mechanically	64.28	51.60
	Spoilage from biological damage		
	Black scars	0.00	0.00
	Eaten by rodents	0.00	0.00
	Total spoilt biologically	0.00	0.00
	Spoilage from other sources	0.00	0.00
	Rotten	0.00	0.00
	Total		
	Total Spoilage(mechanical,biological and others)	64.28	51.60
	Total good Tomatoes	60.32	48.40
	Total Purchased	124.60	100
Before	Spoilage from mechanical damage		
going	Soft tomatoes	10.36	16.70
on next	Burst tomatoes	0.00	0.00
purchase	Total spoilt mechanically	10.36	16.70
	Spoilage from biological damage		
	Black scars	5.35	8.60
	Eaten by rodents	0.00	0.00
	Total spoilt biologically	5.35	8.60
	Spoilage from other sources		
	Rotten	10.06	25.90
	Total	10.06	10.06
	Total Spoilage(mechanical,biological and others	25.77	51.20
	Total Good Tomatoes	30.17	48.70
	Total Left Over	61.95	100

Source: Field Survey, 2010

Management practices

About 98.3% of the respondents cleaned their tomatoes with rag while 1.67% did not clean at all. Cleaning tomatoes brought about spoilage of the tomatoes as shown in Table 3. This agrees with Bourne (1983) who reported that excessive polishing or cleaning and peeling lead to mechanical damage. All the respondents exposed

their tomatoes to the air.This is a healthy practice in the day time but not at night.This is because at night tomatoes could be eaten up by animals.

Among all the methods of storage used overnight, only covering on table was negatively related with spoilage,but was carried out by only 6.7% of the respondents.This means that the more tomatoes are stored using this method the less spoilage. 53.3% left on table open,while 40% left on table covered with polythene. The high level of spoilage of left over produce experienced before the next purchase (as shown in table 2) can be attributed to the fact that very few respondents use the only method of overnight storage shown by the tobit regression to be most effective i.e covering on table with paper.

Table 3. Distribution of respondents by management practices

Management practices	Percentage
Cleaning with rag	98.3
Exposing to air	100
Washing	100
Method of storage	
Leave on table covered with paper	6.7
Leave on table open	53.3
Leave on table covered with polytene	36.7

Source: Field Survey, 2010

Determinants of spoilage of tomatoes

The results of the determinants of spoilage are shown in Table 4.The tobit regression showed that coefficients of income from other sources and number of times of cleaning were significant factors. Income from other sources was significant at 1% level and had apositive sign implying that the probability and the intensity of having spoilt tomatoes increased as income from other sources increased. This may be due to the fact that buying on a small scale incurs more cost relative to buying on a larger scale-the undertone is that when less is purchased and more cost is incurred the retailer is forced to peg his products at a higher price and may be faced with low patronage leading to produce remaining longer and thus being prone to spoilage. This is in line with Kader (2005), who suggests that as the time the produce satys in the market increases from the time of purchase its deterioration rate also increases. This is further confirmed by the coefficient of the number of days to finish selling being positive, though not significant implying that the more the number of days to finish selling the more the spoilage. The regression coefficient of income from other sources was 4.25×10^{-6} and showed that the autonomous level of spoilage of tomatoes of retailers with income from other sources increased by 4.25×10^{-6} to become 0.2073015 whereas that of retailers without income from other sources remained 0.0207259, thereby having a lower probability of spoilage. Notably, also, the coefficient of quantity per purchase though not statistically significant was negatively related with the probability and intensity of spoilage of tomatoes implying that the more the retailers bought more baskets per purchase the less the spoilage. This is in line with the fact that bulk purchase is at alower cost and the retailer can afford to sell at relatively lower prices and hence in less time thus being less predisposed to spoilage.

Table 4: Results of tobit regression

Variable	Parameter value	T-ratio
Education	0.0009544	0.19
ncome 1	-3.76×10^{-7}	-0.52
Income2	4.25×10^{-6}	2.96*
Experience	-0.0015457	-0.28
Age	0.0015875	0.83
Quantity per purchase	-0.0018722	-1.56
Days to finish selling	0.0033322	0.15
Number of times of purchase	-0.00250044	-0.52
Number of times of cleaning	0.1135827	3.02*
Method of washing	0.0278621	0.55
Number of times of washing	0.0397385	0.95
Covered on table with polythene	0.083804	0.85
Opened on table	0.0653975	0.62
Covered on table with paper	-0.0764288	-0.65
Constant	0.0207259	0.05

(*)significant at 1%
Source: Field Survey

The number of times of cleaning was significant at 1% level and was positively related with the probabilty of having spoilt tomatoes. This implies that the more the retailers cleaned their tomatoes, the more the likelihood and intensity of spoilage of tomatoes.This could be because cleaning could bring about peeling of tomatoes thereby causing mechanical damage. This is in line with Bourne (1983),which suggests that chemical damages are caused by peeling, polishing, bruising, spoilage and abrasion. Portela and Cantwell (2001) and Toivonen et al (2005) also observed that the quantity and quality of vegetables and fruits are highly dependent in minimizing injury to the product. The coefficient estimate was 0.1135827 to become 0.1343086 (from the autonomous level of spoilage).
For overnight storage methods; covering on tables with polythene though not significant was positively related with the probability and intensity of spoilage of tomatoes, implying that the more the retailer covered their tomatoes with polthene, the more the likelihood and intensity of spoilage of tomatoes.This is possibly because the poythene generates heat which brings about the deterioration of the tomatoes. Also, leaving the produce open on table, though not significant, was positively related with the likelihood and intensity of spoilage of tomatoes, implying that the more the reailers left their tomatoes open on table as a storage method the more the spoilage. This could be because they may be eaten by birds, insects, larger animals and infected by microbes such as molds and bacteria. FAO (2004) observed that the fruits and vegetables are susceptible to contamination from place of storage. However,covered on table with paper, seems to be the best method because it is negatively related with the probability and intensity of spoilage implying that the more the retailers covered their tomatoes on table with paper instead of other means of storage, the less the likelihood and intensity of spoilage.

CONCLUSION AND RECOMMENDATIONS

As evidence from the study, a high percentage of tomatoes are spoilt on purchase and in transit to the study area. This has serious implication on food security as it is bound to affect the affordability and availability of the fresh produce to consumers. Having income from other sources and the number of times of cleaning the tomatoes with rag are the major determinants of spoilage of tomatoes. Other determinamts include: quantity per purchase, days to finish selling, number of times of washing and method of overnight storage. This study revealed that the only effective method of overnight storage was covering on table with papaer and was carried out by very few respondents. The management practices carried out were not effective as noted by the high percentage of spoilage before going on next purchase. The high percentage of spoilage of tomatoes in the study area is attributed to poor storage methods and the high percentage of spoilage of on purchase is a consequence of poor transprt systems.
Improved transport system (proper vehicles in good conddition and good road network), proper information on the right kind of management practices to carry out, and provision of adequate storage facilities are some measures that could reduce postharvest loss enroute the study area and in the study area. The result of this study calls for the training of retailers of tomatoe on proper management practices like the use of paper to cover the produce instead of polythene, as this is the most effective overnight storage method as revealed by this study, and discouraging them from polishing excessively and washing as this predisposes the produce to spoilage.

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