



EFFECT OF SOCIO-ECONOMIC CHARACTERISTICS ON POSTHARVEST LOSSES AMONG SWEET ORANGE MARKETERS IN BENUE STATE, NIGERIA

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ABSTRACT

The study examined the effect of socio-economic characteristics on postharvest losses among sweet orange marketers in Benue State, Nigeria. Survey research design was adopted. Multistage sampling technique was used to randomly select 280 marketers of sweet orange. Primary data for the study were obtained the aid of questionnaire. Descriptive statistics and multiple regression analysis were used to analyze data, respectively. Findings showed that average quantity of sweet orange purchased was 206.93, while the average quantity loss was 37.75 50 kg bag equivalence, putting average percentage postharvest loss at 18.24%, and translating to an average revenue loss of ₦186,404.22. With the semi-log functional form as the lead equation, the t-ratio of years spent in school (7.481), membership of cooperative society (0.182), age (-6.00) and orange marketing experience (-20.374) were statistically significant ($p < 0.05$). Further, the F-statistics (2970.457) was statistically significant ($p < 0.01$) and the R^2 (0.987) of the model was high. Furthermore, age and orange marketing experience decrease the magnitude of postharvest losses. On the other hand, formal education and membership of cooperative society were inversely related to the magnitude of postharvest losses. It was concluded that the level of postharvest of sweet orange among the marketers translates to substantial loss in revenue since their scale of operation is low and there is no compensation for the losses. It was recommended that the age and marketing experience should be considered for any form of intervention in the management of postharvest losses among sweet orange marketers.

Keywords: Orange, Agricultural marketing, Postharvest losses, Food security, Marketing experience.

INTRODUCTION

Sweet orange belongs to family *Rutaceae* with about 150 genera (Opeke, 2005; Ehler, 2011). According to Food and Agriculture Organization (FAO, 2013) and Alva *et al.* (2006) global production of sweet orange was at 102 million metric tons per annum which far exceeded annual production value of other popular fruits such as banana, mango and apple. FAO (2011) revealed that annual citrus fruit production is 105 million metric tons and there has been a steady rise in the production globally due mainly to increase in hectare, consumer preference for healthier, convenience food and rising income (United Nations Conference on Trade and Development (UNCTAD, 2010). The common species of citrus produced worldwide include grape fruit (*Citrus paradisi*), sweet orange (*Citrus sinensis*), lemon (*Citrus limon*), lime (*Citrus aurantifolia*), mandarin/tangelo (*Citrus reticulata*), pummelo/shaddock (*Citrus grandis*), sour or Seville orange (*Citrus aurantium*) and rough lemon (*Citrus jambhiri*) as reported by Etebu and Nwauzoma (2014).

Current world population is expected to reach 10.5 billion by 2050 (FAO, 2013), further adding to global food security concerns. This increase translates into 33 % more human mouths to feed, with the greatest demand growth in the poor communities of the world. According to Alexandratos and Bruinsma (2012), food supplies would need to increase by 60



% (estimated at 2005 food production levels) in order to meet the food demand in 2050. Food availability and accessibility can be increased by increasing production, improving distribution, and reducing the losses. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security. Food losses have received increased attention in recent times (Kwami and Nitty, 2014). It has been estimated that about 1.3 billion tons of food are lost each year (FAO, 2003; Gustavsson *et al.*, 2011). While a reasonable part of food losses results from food waste in developed countries, a major portion of developing countries is owing to high post-harvest losses (PHLs) in food supply chains (FSC) (Chukwunta, 2014).

In agriculture, post-harvest handling is the stage of crop production immediately following harvest which includes storage, cleaning, packaging, transportation and sorting (Mukaminega, 2008; Meena *et al.*, 2009;). The important goals of post-harvest handling are to keep the produce cool, thereby avoiding moisture loss, slowing down undesirable chemical changes and avoidance of physical damage such as bruising to delay spoilage (Ortese *et al.*, 2012). This in turn will help to ensure increased food security, as food security goes beyond food production to include distribution and marketing, adequate and stable supply and accessibility of food (Idah *et al.*, 2007; Ortese *et al.*, 2012).

FAOSTAT (2014) estimated that the production of citrus in Nigeria in 2014 was about 3.4 million metric tonnes, making the country the world's 8th highest producer of the commodity and providing 2.7 % of the world's total production. Benue State is a major citrus producing State in the country. Others include Nasarawa, Osun, Anambra, Ekiti, Imo, Kogi, Ebonyi, Edo, Delta, Oyo, Kwara, Ogun, Taraba and Kaduna (Olife *et al.*, 2015), with Benue State giving the highest annual production of citrus fruits. Most citrus production in Nigeria is accounted for by oranges but significant quantities of grape fruits, lemon and lime are also grown (Benue State Agricultural and Rural Development Authority [BNARDA], 2012). In Benue, citrus is the most important tree crop, having a total estimated population of about 2 million trees with an area of 925,073 ha (BNARDA, 2012).

In Nigeria, where the agriculture sector contributes more than 30 % of the Gross Domestic Product (GDP) and employs about 70 % of the labour force, high PHLs has continued to be observed in food supply chains (FSCs) of perishable agricultural commodities such as citrus fruits (Olayemi *et al.*, 2012). To increase the current level of production, there is need to examine other ways through which productivity increases could come (Atagher, 2013). In the move towards agricultural renaissance, it is important to note that commercial farms are profitable only if they generate sufficient income (on and off-farm) and accumulate adequate capital for possible re-investment (Ogbanje, 2015).

Post-harvest losses have been the bane to food security and improved farmer's income generation in Nigeria (Odigboh, 2004; Ayandiji, 2010), and Benue State in particular. This has continued to impact negatively on food production and availability (Olayemi *et al.*, 2011). According to World Bank (2011) food losses are reported to have risen (50–70 %) between production areas and point of consumption. The trend is associated with inadequate post-harvest handling and non-adoption of available post-harvest technologies for reduction of losses (Francis, 2010). In Nigeria, post-harvest losses of fruits and vegetables amounts to 35–45 % of the annual production (FAO, 2004). This is because generally, handling procedures are not fully recognized and understood (Azizah *et al.*, 2009). Ayandiji and Davies (2016) reported that these losses lead to heavy loss of income and food supplied to rural families, thereby threatening household food security and that, in the face of threat of household food security, malnutrition easily results. This has affected adversely the traditional role agriculture plays in the economy of Nigeria as a foreign exchange earner, and as a source of income and



employment generation for farmers. (Nigerian Institute of Food Science and Technology [NIFST], 2012).

The extent to which socioeconomic characteristics of sweet orange farmers are implicated in postharvest losses constitutes the focus of this study. Hence, the specific objectives of the study were to describe the effect of socio-economic characteristics of sweet orange marketers in Benue State; and determine the extent of post-harvest losses of sweet orange marketing in Benue State. It was hypothesized that socio-economic characteristics of sweet orange marketers have no significant effect on their post-harvest losses.

MATERIALS AND METHODS

The Study Area

The study adopted survey design approach. In survey research, the researcher selects representative sample from the population and administers a standard questionnaire to them. In survey design process, events are observed at one time or from a single observation of a sample (Iheanacho and Iheanacho, 2012). This study was conducted in Benue State of Nigeria, which derives its name from the river Benue, which is the second largest River in Nigeria. Benue State is located in the North-Central geo-political zone of Nigeria. The State lies between latitudes $6^{\circ}3^{\circ}$ North and $8^{\circ}1^{\circ}$ North of the equator and longitudes $6^{\circ}35'$ East and $10^{\circ}:00'$ East of the Greenwich Meridian (Okwu *et al.*, 2011). The State shares an international boundary with five States, namely, Nasarawa to the North, Taraba to the East, Cross River to the South-East, Enugu to the South-West, and Kogi to the West. The Southern part of the State also shares boundary with the Republic of Cameroun (Benue State Agricultural and Rural Development Authority [BNARDA], 2012). Benue State has an estimated population of about 4, 353, 228 in year 2006, and 5,741,800 (2016 projection) people, using a population growth rate of 3.2 % based on the 2006 National Population Census (NPC, 2006). Benue State occupies a land mass of 33,955 Square kilometers. Benue state is made up of 23 Local Government Areas (LGAs) with Makurdi as its capital and is divided into three agricultural zones A, B and C). Tiv, Idoma and Iggede are the major tribes spoken in the State. Benue State possesses a rich and diverse cultural heritage which finds expression in colorful cloths, exotic masquerades, music and dances.

Benue State has a tropical climate, with two distinct seasons, namely, the rainy season from April to October and the dry season from November to March. Average annual rainfall varies from 1,750 mm in the southern part of the state to 1,250 mm in the Northern part. The hot season comes in mid-April with temperatures between 32°C and 38°C . About 75% of the population lives in the rural areas and their main occupation is farming. With farmers predominantly engaged in rain-fed subsistence farming. The average farmer in Benue state has a farm holding of between 1.5 to 2.0 hectares (BNARDA, 1999). Benue state is referred to as the “food basket” of Nigeria because of the abundance of its agricultural resources (BNARDA, 2012). The State is a major producer of food crops like yam, rice, sorghum, cassava, sweet potatoes, sesame, millet, beans, and a wide range of other crops like vegetables, groundnut, ginger and sugarcane. Tree crops like oil palm, cashew, mango, coconut, bananas and citrus also grow very well in the state. Irrigation farming along the banks of River Benue is becoming a common feature in the State.

Sampling Procedure

The population of the study comprises of all sweet orange marketers in Benue State, Nigeria. However, since it will be impractical to study the entire population, a sample of the population was taken for the study. Multi-stage sampling technique was adopted for the study. In stage one, sweet orange producing LGAs was purposively selected from each of the



agricultural zones owing to the Agricultural Production Survey report by BNARDA (2012). In Zone A, the LGAs were Ushongo, Logo, Vandeikya, Konshisha and Katsina-Ala. Buruku, Gwer-East, Gwer-West, Tarka and Gboko from Zone B and Ohimini and Oju from Zone C. In stage two, three communities engaged in sweet orange marketing were randomly selected from each of the LGAs. Finally, a population allocation formula was employed to determine the sample size drawn from each of the three agricultural zones to give a total sample size of 280 respondents for the study.

The sample size of 280 was arrived at using Taro Yamane's formula (1967) as cited in Eze (2008). The formula is:

$$n = \frac{N}{1+N(e^2)} \quad \dots(1)$$

where;

n = sample size

N = abridged population size,

e = tolerable error size (0.05).

The Bourley (1964) population allocation formula as cited in Eze (2008) was used to determine the sample size drawn from each of the purposively selected States. The formula is stated as follows:

$$nh = \frac{n.Nh}{N} \quad \dots(2)$$

where;

nh = sample per purposively selected community

n = total sample size from Taro Yamane's formula

Nh = abridged population per purposively selected community

N = abridged population.

Method of Data Collection

Data for the study were collected using a structured Pretested questionnaire. The instrument elicited information on socio-economic characteristics of farmers such as, age, sex, educational level, family size, farming experience, marital status, membership of cooperative societies and contact with extension agents; causes of post-harvest losses of citrus; effects of losses on the income of citrus farmers; and measures for reducing post-harvest losses sweet orange by the marketers. The data collected include socio-economic profiles of sweet orange marketers and magnitude postharvest losses of citrus.

Method of Data Analysis

The data were analyzed using descriptive statistics. Multiple regression analysis was used to test hypothesis of the study. This was done by fitting three different functional forms namely, linear, semi-logarithm and double-logarithm. Econometric methods such as the size and significance of F-statistic, size of R-squared, and the number and signs of significant independent variables as well as the F-statistics were used to select the functional form that best fits the data. The models were specified as:

Linear function:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + e_i \quad \dots(5)$$

Semi-log function:

$$Y = B_0 + B_1\log X_1 + B_2\log X_2 + B_3\log X_3 + B_4\log X_4 + B_5\log X_5 + B_6\log X_6 + B_7\log X_7 + e_i \quad \dots(6)$$

Double-log function:

$$\log Y = B_0 + B_1\log X_1 + B_2\log X_2 + B_3\log X_3 + B_4\log X_4 + B_5\log X_5 + B_6\log X_6 + B_7\log X_7 + e_i \quad \dots(7)$$

where;



- Y = bags of orange lost (50kg)
X₁ = Gender (1 = male, 0 otherwise)
X₂ = Age (years)
X₃ = Marital status (1 = married, 0 otherwise)
X₄ = Household size
X₅ = Education (years spent in school)
X₆ = Orange marketing experience (years)
X₇ = Membership of cooperative society (1 = yes, 0 otherwise)

RESULTS AND DISCUSSION

The socio-economic characteristics of sweet orange Marketers are presented in Table 1. The results showed that majority (78.9 %) of the respondents were males while a few (21.1 %) were females. This implies that more males than females were involved in sweet orange marketers. This may be due to the labor-intensive nature of the enterprise which could be very hectic and time consuming, especially for females who would have to combine these activities with domestic chores. Also, citrus is usually planted on large hectares of land and most of these lands are family farms which are usually inherited by male members. It is only in a few cases that females inherited such lands.

Results also revealed that about 14.6 % of the respondents were in the age bracket of 15-25 years, 27.5 % were in the age group of 27-37 years, 37.5 % of the respondents constituted the age bracket of 38-48 years, and 49-69 years accounted for 20.4 % with the mean age 39.01 years. The findings indicated that majority (65 %) of the sweet orange marketers were within the age bracket of 27- 48 years. It is likely that majority of the marketers above 67 years must have handed over to others because of the rigorous nature, leaving their farms to their children in the lower age categories. It could be that those who are less than 16 years may still be in school and even might have inherited them from dead relatives.

Household size of those engaged in sweet orange marketers was dominated by 5-7 individuals (56.7 %), followed by those whose families comprised 2-4 persons (21.8 %) and 8-10 people (21.1 %) respectively. while those with household sizes greater than 13 people were the least (0.4 %) with an average of 6 persons per household. This shows that majority of those involved in this enterprise have large families which indicates the key role played by sweet orange marketers in supporting family life as the respondents do not only provide for themselves but also for their dependents. This finding is in conformity with those of Ortese *et al.* (2012) who reported that 44.4 % of citrus farmers in Benue State had 6-10 individuals in their households and Agea *et al.* (2008) who stated that most farm families in Nigeria are in the range of 6-10 persons.



Table 1: Socio-economic Characteristic of Sweet Orange marketers (n = 280)

Characteristics	Frequency	Percentage	Mean
Gender			
Female	59	21.1	
Male	221	78.9	
Marital status			
Married	166	59.3	
Single	114	40.7	
Formal education(years)			
Attended formal education	248	88.6	
Do not attend formal education	32	11.4	
Occupation			
Partial citrus marketers	87	31.1	
Full time citrus marketers	193	68.9	
Cooperative membership			
Members	152	54.3	
Non-members	128	45.7	
Age (years)			
15-25	41	14.6	39
26-36	77	27.5	
37-47	105	37.5	
48-58	31	11.1	
59-69	26	9.3	
Household size(number)			
2-4	61	21.8	7
5-7	158	56.4	
8-10	59	21.1	
11-13	2	0.71	
Marketing experience(years)			
2-9	102	36.4	15
10-17	59	21.1	
18-25	68	24.3	
26-33	51	18.2	

Source: Field survey data, 2019

Results on number of years of formal education indicated that most (88.6 %) of the respondents had formal education and 11.4 % had no formal education. This implies that many citrus marketers have had considerable level of formal education that would enhance their



understanding and methods of preventing post-harvest losses in citrus fruits. This finding agrees with Ayandiji (2010) that 66.7 % of citrus marketers had 1-12 years of formal education. According to the report basic skills required to control post-harvest losses in sweet orange would have been acquired at the primary and secondary school levels. Majority (68.9 %) of the respondents were full-time sweet orange marketers relying solely on for their sweet orange marketing for their livelihood while 31.1 % of the respondents were part-time sweet orange marketers who had other sources of income other than citrus marketing.

As presented in Table 1, majority (36.4 %) of the sweet orange marketing experience was between 2-33 years with an average marketing experience of 15 years. Experience is important in marketing business especially when dealing with perishable agricultural produce like citrus. An experience citrus marketer will be aware of when to buy, how to bag and transport his produce. This finding agrees with that of Meena *et al.* (2009) who found average involvement in citrus to be 15 years which implies that the respondents were well experienced in their marketing.

Magnitude of Postharvest Losses in Sweet Orange

The analysis of the magnitude of postharvest losses in sweet orange among the marketers is presented in Table 2. The result shows that average quantity of sweet orange purchased was 206.93 50 kg bag equivalence, while the average quantity lost was 37.75 50 kg bag equivalence, putting average percentage postharvest loss at 18.24%. For small-scale marketers, this level of postharvest loss is substantial since there is no compensation. In addition, the loss will affect sales and profitability especially as oranges are perishable in nature. At the selling price of ₦1,350.00, this loss translates to an average revenue loss of N186,404.22 among the marketers.

Table 2: Magnitude of Postharvest Losses in Sweet Orange

Variable	Minimum	Maximum	Mean	Std. Deviation	
			Statistics	Std. Error	
Number of 50kg bags bought	97.00	260.00	206.93	2.67	44.73
Number of bags lost	15.00	78.00	37.75	1.21	20.28
Percentage of Postharvest loss (%)	15.46	30.00	18.24	45.32	45.34

Source: Field survey data, 2019

Effect of Socio-economic Characteristics of sweet orange Marketers on Post-Harvest Losses

As shown in Table 3, three different functional forms were fitted namely, linear, semi-log and double-log. Out of these, the semi-log functional form was selected as the best fit. This was based on econometric criteria like the largest F-statistics and highest coefficient of determination (R^2). In terms of the number of significant independent variables, the double-log functional form had more (5) significant independent variables than the semi-log (4), the semi-log form was still preferred because the F-statistics and R^2 were larger.

In the semi-log model, the F-statistic (2970.457) was statistically significant ($p < 0.01$). Thus, the null hypothesis can be rejected and the alternative hypothesis accepted. The implication is that socioeconomic characteristics have significant effect on postharvest losses among orange marketers in Benue State. The R^2 of the model was 0.987, implying that the independent variables in the model accounted for 98.7% of the variations in the post-harvest



losses. Excluded independent variables would be responsible for the remaining 1.3% of the variations in post-harvest losses.

The t-ratio of years spent in school (7.481) was statistically significant ($p < 0.01$). Its coefficient was positive (0.033). This means that one unit increase in years spent in school led to increase in post-harvest losses by 3.3 bags. Increase in post-harvest losses is undesirable. This finding suggests that formal education had no relevance to post harvest loss management of orange. In other words, formal education in the country lacks technical content where students would be able to acquire skills that would enhance the management of their agro-based enterprises. Although, this is contrary to expectation, the possibility lies in the fact that marketers who are able to attain reasonable level of formal education would give less attention to selling unprocessed orange as they search for white collar jobs.

Similarly, the t-ratio of membership of cooperative society (0.182) was statistically significant ($p < 0.05$). Its coefficient was positive (0.20). This means that as the membership of cooperative society increased by one-member, post-harvest loss increased by 20 bags. This finding also suggests that membership of cooperative society had no relevance to post harvest loss management of orange in the study area. In other words, the attention of the cooperative society has not been drawn to the need to manage post-harvest loss. This could imply that the society has neither trained nor given adequate training to the members on the adverse consequences of post-harvest loss and the need to minimize the loss.

The study further reveals that the t-ratio (-6.00) of age was statistically significant ($p < 0.01$). Its coefficient was negative (-0.008). This means that increase in age of the respondents by one year led to decrease in post-harvest losses by 0.8 bags. Decrease in post-harvest losses is desirable within agribusiness context. This finding implies that as the marketers advanced in age, he acquired more wisdom that is relevant to minimize post-harvest loss. The marketer's responsibility probably increased and he becomes warier of the adverse effect of post-harvest loss.

Similarly, the t-ratio (-20.374) of orange marketing experience was statistically significant ($p < 0.01$). Its coefficient was negative (-0.029). This means that increase in orange marketing experience of the respondents by one year led to decrease in post-harvest losses by 2.9 bags. This implies orange marketing experience afforded the respondents the needed skills to control post-harvest loss of their orange. In other words, the marketers would have tried several post-harvest management methods over time and now knows the method that is more effective.



Table 3: Effect of Socio-economic Characteristics of Sweet Orange Marketers on Post-Harvest Losses

Model	Linear	Semi-log	Double-log
Constant			
Coefficients	6.394	3.686	3.975
Std. Error	3.946	0.071	.237
t-ratio	1.620	51.777*	16.753*
P-value	0.106	0.000	0.000
Gender			
Coefficients	0.259	0.017	0.019
Std. Error	0.525	0.009	0.012
t-ratio	0.494	1.760	1.597
Sig	0.622	0.080	0.111
Age (years)			
Coefficients	0.134	-0.008	-0.286
Std. Error	0.072	0.001	0.077
t-ratio	1.867	-6.000*	-3.731*
P-value	.063	0.000	0.000
Marital status			
Coefficients	-0.431	-0.011	-0.006
Std. Error	0.429	0.008	0.010
t-ratio	-1.005	-1.419	-0.608
Sig	0.316	0.157	0.544
Household size			
Coefficients	0.143	0.006	0.184
Std. Error	0.448	0.008	0.049
t-ratio	0.320	0.761	3.775*
P-value	0.749	0.448	0.000
Years spent in school			
Coefficients	3.825	0.033	0.379
Std. Error	0.242	0.004	0.030
t-ratio	15.826*	7.481*	12.839*
P-value	0.000	0.000	0.000
Orange marketing experience			
Coefficients	-0.554	-0.029	-0.305
Std. Error	0.079	0.001	0.024
t-ratio	-6.976*	-20.374*	-12.588*
P-value	0.000	0.000	0.000
Membership of cooperative society			
Coefficients	4.450	0.200	0.213
Std. Error	1.020	0.018	0.022
t-ratio	4.363*	0.182*	9.827*
P-value	0.000	0.000	0.000
R-square	0.971	0.987	0.980
Adjusted R-square	0.970	0.987	0.979
F-statistic	1294.683*	2970.457*	1866.572

*Statistical significance at 0.01 level

Source: Field survey data, 2019



CONCLUSION AND RECOMMENDATIONS

It was concluded that the level of postharvest of sweet orange among the marketers translates to substantial loss in revenue since their scale of operation is low and there is no compensation for the losses. Furthermore, age and orange marketing experience decrease the magnitude of postharvest losses. On the other hand, formal education and membership of cooperative society were inversely related to the magnitude of postharvest losses.

Consequently, the study recommended that the age and marketing experience should be considered for any form of intervention in the management of postharvest losses among sweet orange marketers. It is also important that marketers who have formal education and inclination to cooperative society administration should be encouraged to move to another level of sweet orange value chain other than marketing.

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